Anritsu

OPERATION MANUAL

DATA TRANSMISSION ANALYZER

MD6401A

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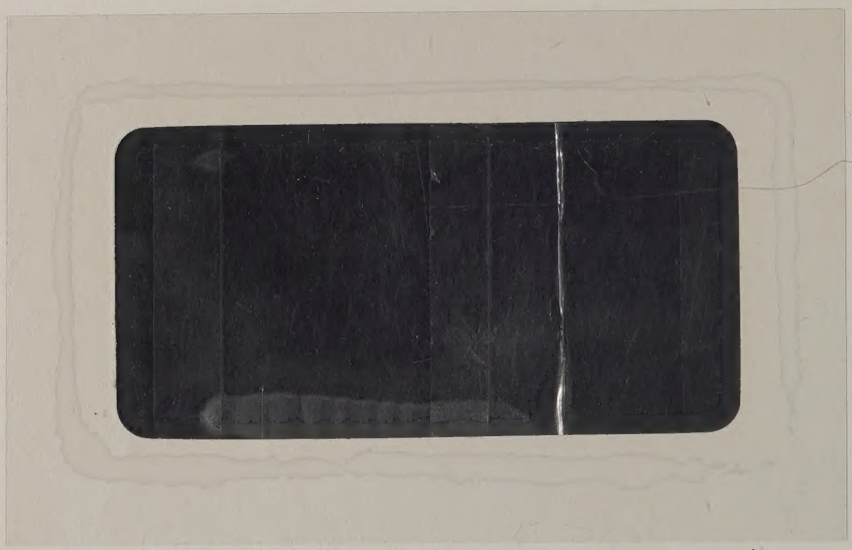

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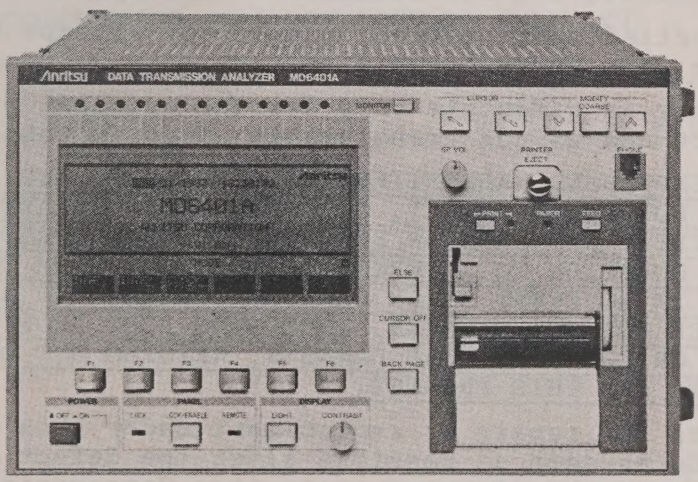

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Anritsu further certifies that its calibration measurements are based on the Japanese Electrotechnical Laboratory and Radio Research Laboratory standards.

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WARNING

NO OPERATOR SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED PERSONNEL.

CAUTION

FOR CONTINUED FIRE PROTECTION REPLACE
ONLY WITH SPECIFIED TYPE AND RATED FUSE.

Note:

1. The instrument is operable on nominal voltages of 100 to 127 Vac or 200 to 250 Vac by changing the internal connection.

   The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.

   To operate on the other voltage, consult your nearest Anritsu service personnel.

2. In this manual, the power supply voltage and current ratings are represented by **Vac and ***A, respectively.

3. The relationship between power supply voltage and current ratings is shown below.

**Vac	***A
100 to 127 V	5 A
200 to 250 V	5 A

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SECTION 1

GENERAL

1.1 Overview

The MD6401A Data Transmission Analyzer is designed to permit interface measurement of modems, DSUs, multimedia multiplexing devices, PBXs on terminals and transmission lines when it is combined with the required measurement units.
Signals are exchanged with the data terminal (printer, FAX, etc.) to test the performance of the terminal.

1.2 Features and Principal Functions

1. Devices from low-speed modems to high-speed digital lines

   - The MD6401A can handle interfaces with bit rates of 50 b/s to 10 Mb/s just by changing the interface unit. Since up to five interface units can be installed, it is perfect for developing and maintaining many types of system.

2. Full error measurement

   . Error count (bit errors, code errors, parity errors, CRC errors, block errors)

   . Error rate (bit error rate, code error rate, parity error rate, CRC error rate, block error rate)

   . ES, %ES

   . DM, %DM

   . SES, %SES

   . US, %US

Since the above items can be measured at the same time and any three of them can be displayed simultaneously, events corresponding to the line status can be determined easily.

3. Signal-line (control and data) DC-voltage measurement

4. Built-in frequency counter for signal-line frequency measurement

5. Signal-line pulse counting at rising edge

6. Transmission-system absolute delay-time measurement

7. Measurement of time between conversion points of signal line

8. Time measurement of phase difference between any two signals

9. Signal-line monitor

10. Code (A, Z, 1:1, 1:3, etc.), programmable pattern, psuedorandom pattern (8 kinds), word pattern (8 bits X 8K words), and FOX pattern (CCITT) generation

11. Single-error and cyclic-error addition

12. Built-in clock (year, month, day, hour, minute, second)

13. Set-contents back-up

14. Pattern-trace function traces monitored signal pattern and displays it using HEX, ASCII, JIS8, EBCDIC, and EBCDIK codes

15. Measured results output to built-in printer

16. Measurements made between different interfaces by specifying sending system interface and receiving system interface separately

17. GP-IB and RS-232C remote control interface (MD0620A GP-IB, MD0620B RS-232C Remote Control Units)

18. Single-point distortion, bias distortion, and start-stop distortion measurement (MD0610A Distortion Measuring Unit)

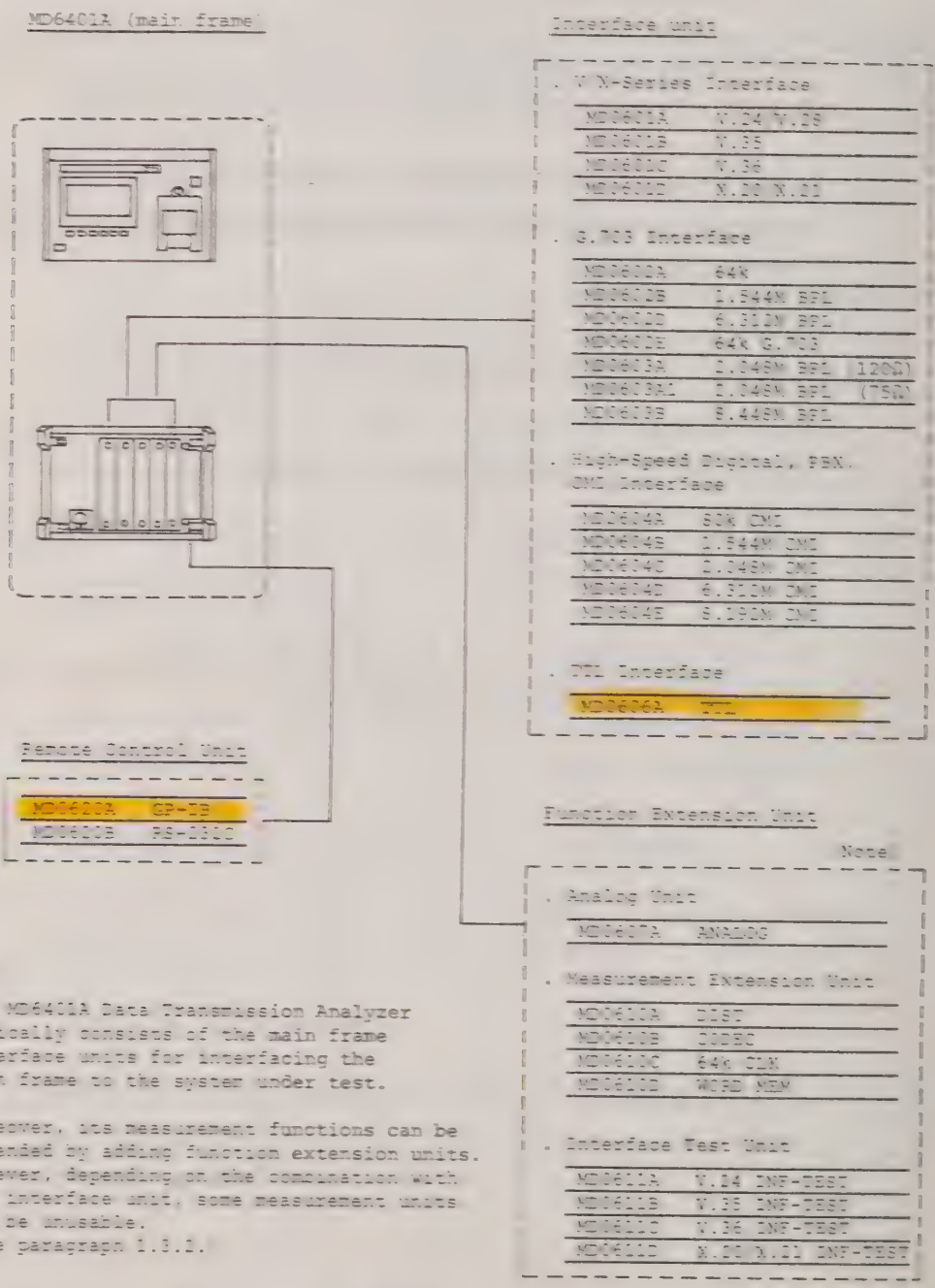
19. Interface test function automatically measures voltage, input/output impedance, etc. of CCITT electrical interfaces (V.10, V.11, V.28, V.35) (MD0611A/B/C/D Interface Test Units)

20. Sine-wave generation and sine-wave level/frequency measurement (MD0607A Analog Interface Unit)

21. Voice coding/decoding and digital level measurement (MD0610B Codec Unit)

1.3 System Configuration

Various measuring system can be configured by combining the MD6401A Data Transmission Analyzer with various plug-in units.



Note:

The MD6401A Data Transmission Analyzer basically consists of the main frame interface units for interfacing the main frame to the system under test.

Moreover, its measurement functions can be extended by adding function extension units. However, depending on the combination with the interface unit, some measurement units may be unusable.
See paragraph 1.3.1.

Fig. 1-1 MD6401A Configuration

1.3.1 Overview of main frame and units

A measuring system can be configured by combining the MD6401A Data Transmission Analyzer main frame and various units (interface unit, function extension unit, remote control unit) as shown in Fig. 1-1.

(1) Main frame

The main frame uses an LCD and has a built-in printer. The rear panel has five slots for interface units or measurement extension units and one slot for a remote control unit.

(2) Interface units

Seventeen kinds of interface units, from low-speed terminal interfaces to high-speed digital interfaces, are available as shown below.

(a) V/X-series interface unit

Table 1-1

Model	Name	Explanation
MD0601A	V.24/V.28	Interface based on CCITT Recommendations V.24/V.28 RS-232C Electrical level: Unbalanced line V.28
MD0601B	V.35	Interface based on CCITT Recommendation V.35 Electrical level: Balanced line V.35, unbalanced line V.28
MD0601C	V.36 (RS-449)	Interface based on CCITT Recommendation V.36 Electrical level: Balanced line V.11, unbalanced line V.10
MD0601D	X.20/X.21	Interface based on CCITT Recommendations X.20/X.21 X.20 (RS-423), electrical level: unbalanced line V.10 X.21 (RS-422), electrical level: balanced line V.11

(b) G703 interface unit

Table 1-2

Model	Name	Explanation
MD0602A	64k	Interface based on centralized clock interface of method recommended by CCITT. G.703 64 kb/s interface 110 Ω balanced input/output Code: AMI (NRZ)
MD0602B	1.544M BIPOLAR	1.544 Mb/s interface complying with CCITT Recommendations G.703, G.704 and G.734 Corresponds to interface with frame CRC-6 ($x^6 + x + 1$) generation and detection 100 Ω balanced input/output Frame: 24 multiframe (SEF), 12 multiframes (D4), single frame Code: AMI, B8ZS, B6ZS
MD0602D	6.312M BIPOLAR	6.312 Mb/s interface complying with CCITT Recommendations G.703 and G.704 Corresponds interface with frame CRC-5 ($x^5 + x^4 + x^2 + 1$) generation and detection 110 Ω balanced or 75 Ω unbalanced input/output Frame: 4 multiframes Code: AMI, B8ZS, B6ZS
MD0602E	64k G.703	Interface recommended by CCITT Recommendations G.703 64 kb/s interface (Codirectional, contradirectional, centralized clock) 100 Ω balanced input/output Code: AMI
MD0603A	2.048M BIPOLAR	2.048 Mb/s interface complying with CCITT Recommendations G.703 and G.704 CRC-4 ($x^4 + x + 1$) generation and detection 120 Ω balanced input/output Corresponds to interface with frame Frame: 2 multiframes, 16 multiframes Code: AMI, HDB3

Table 1-2 (Cont'd)

Model	Name	Explanation
MD0603A1	2.048M BIPOLAR	2.048 Mb/s interface complying with CCITT Recommendations G.703 and G.704 CRC-4 ($x^4 + x + 1$) generation and detection 75 Ω unbalanced input/output Corresponds to interface with frame Frame: 2 multiframes, 16 multiframes Code: AMI, HDB3
MD0603B	8.448M BIPOLAR	8.448 Mb/s interface complying with CCITT Recommendations G.703 and G.741 75 Ω unbalanced input/output Code: AMI, HDB3

(c) High-speed digital, PBX, CMI interface unit

Table 1-3

Model	Name	Explanation
MD0604A	80k CMI	NTT high-speed digital-line user-network interface (80 kb/s) 110 Ω balanced input/output Frame: CRV 20 multiframes
MD0604B	1.544M CMI	NTT high-speed digital-line user-network interface (1.544 Mb/s) 110 Ω balanced input/output Frame: CRV 24 multiframes
MD0604C	2.048M CMI	TCC Recommendation PBX-TDM interface etc. 2.048 Mb/s interface 110 Ω balanced input/output Frame: CRV 8 multiframes, CRV only
MD0604D	6.312M CMI	NTT high-speed digital-line user-network interface (6.312Mb/s) 110 Ω balanced input/output Frame: CRV 4 multiframes
MD0604E	8.192M CMI	NTT inter-office 8M CMI interface Corresponds to CRC-6 ($x^6 + x^4 + x^3 + 1$) generation and detection 75 Ω unbalanced input/output Frame: CRV Highway frame

(d) TTL interface unit

Table 1-4

Model	Name	Explanation
MD3604A	TTL	TTL level input/output interface

(3) Function extension units

Measurement functions not available in the main frame can be added by installing these units. These function extension units do not operate independently when inserted into the main frame; when they are used, at least one interface unit is necessary. (See paragraph 1.3.2.)

(a) Analog interface unit

Table 1-5

Model	Name	Explanation
MD1607A	ANALOG	600 Ω system sine-wave send and receive, and level and frequency measurements can be made.

(b) Measurement extension unit

Table 1-6

Model	Name	Explanation
MD0610A	DIST	Bias distortion, single-point distortion, and start-stop distortion can be measured by using this unit with the MD0601A/B/C/D and MD0606A.
MD0610B	CODEC	Digital-level measurement and signal coding/decoding of 64 kb/s PCM signals at a specified time slot can be performed by using this unit with the MD0602A/B/E, MD0603A/A1, and MD0604A/B/C.
MD0610C	64k CLK	A (64k + 8k) b/s clock generator can be configured by using this unit with the MD0602A/E. 100 Ω balanced output
MD0610D	WORD MEM	This unit contains a pattern-generation word pattern ROM for all interface units.

(c) Interface test unit

Table 1-7

Model	Name	Explanation
MD0611A	V.24 INF-TEST	The electrical characteristics of CCITT V.28 interfaces can be measured and assessed to see whether or not the results meet CCITT specifications by using this unit with the MD0601A Interface Unit.
MD0611B	V.35 INF-TEST	The electrical characteristics of the CCITT V.35 and V.28 interfaces can be measured and assessed to see whether or not the results meet CCITT specifications by using this unit with the MD0601B Interface Unit.

Table 1-7 (Cont'd)

Model	Name	Explanation
MD0611C	V.36 INF-TEST	The electrical characteristics of the CCITT V.10 and V.11 interfaces can be measured and assessed to see whether or not the results meet CCITT specifications by using this unit with the MD0601C Interface Unit.
MD0611D	X.20/X.21 INF-TEST	The electrical characteristics of the CCITT V.10 and V.11 interfaces can be measured and assessed to see whether or not the results meet CCITT specifications by using this unit with the MD0601D Interface Unit.

(4) Remote control unit

The main frame can be controlled remotely by inserting a remote control unit into the remote control unit slot at the rear of the main frame and connecting a controller (PACKET V or other personal computer).

Table 1-8

Model	Name	Explanation
MD0620A	GP-IB	IEEE-488 specification GP-IB interface unit
MD0620B	RS-232C	EIA-RS-232C specification serial interface unit

1.3.2 Application with function extension unit

Measurements can be made with the main frame and at least one interface unit. More measurements are possible by adding function extension units. However, depending on the interface unit, some function extension units may be unusable. (See the table on the next page.)

Table 1-9 Relationship between Function Extension Units and Interface Units

O: usable

Model unit name	Function extension unit									Remote control unit	
	MD0607A ANALOG	MD0610A DIST	MD0610B CODEC	MD0610C 64k CLK	MD0610D WORD MEM	MD0611A V.24 INF-TEST	MD0611B V.35 INF-TEST	MD0611C V.36 INF-TEST	MD0611D X.20/X.21 INF-TEST	MD0620A GP-IB	MD0620B RS-232C
MD0601A V.24/V.28	O	O			O	O				O	O
MD0601B V.35	O	O			O		O			O	O
MD0601C V.36	O	O			O			O		O	O
MD0601D X.20/X.21	O	O			O				O	O	O
MD0602A 64k	O		O	O	O					O	O
MD0602B 1.544M BPL	O		O		O					O	O
MD0602D 6.312M BPL	O				O					O	O
MD0602E 64k G.703	O		O	O	O					O	O
MD0603A 2.048M BPL	O		O		O					O	O
MD0603A1 2.048M BPL	O		O		O					O	O
MD0603B 8.448M BPL	O				O					O	O
MD0604A 80k CMI	O		O		O					O	O
MD0604B 1.544M CMI	O		O		O					O	O
MD0604C 2.048M CMI	O		O		O					O	O
MD0604D 6.312M CMI	O				O					O	O
MD0604E 8.192M CMI	O				O					O	O
MD0606A TTL	O	O									O

SECTION 2

COMPOSITION AND SPECIFICATIONS

2.1 Composition

The standard composition of the MD6401A Data Transmission Analyzer is shown in Table 2-1.

Table 2-1 Standard Composition

Item	No.	Name	Qty.	Remarks
Instrument	1	MD6401A Data Transmission Analyzer	1	
Accessories supplied	2	Fuse	2	T***A250V
	3	Printer paper	2 rolls	
	4	Protective cover	1	
	5	Power cord	1	
	6	Operation manual	1	

2.2 Specifications

When the MD6401A Data Transmission Analyzer and the units are combined and the operating environment specifications below are met, the specifications are as follows.
Up to 5 units can be used with the MD6401A.

2.2.1 Operating environment

Temperature: 0° to 50°C, normal humidity: 65% ±20%, power: 85 to 132/170 to 250 Vac (switchable, max. 250 Vac, 47 to 63 Hz)

2.2.2 Speed

50 b/s to 10 Mb/s according to specifications of unit.

2.2.3 Signal generator

(1) Send pattern

(a) A, Z, 1:1, 3:1, 1:3, 7:1, 1:7, 4:1, 1:4

*1:4 and 4:1 are not effective at start-stop sync 8 bit length/interface-with-frame time-slot/64 k and 64 k G.703 interface measurement.
(Ex. 2.0M BPL and 1.5M BPL interfaces)

(b) Programmable pattern (5 to 8 bits at ST/SP, 5 bits at 2M BPL spare bit, other 8 bits)

(c) Pseudorandom pattern (polarity reversible 2^n-1 bit repetition, n: 6, 7, 9, 11, 15, 19, 20, 23)

(d) Word pattern (8 bits x 8 kwords, manual or remote setting, battery back-up possible)

(e) Memory pattern (8 bits x 8 kwords, user ROM pattern send, only when MD0610D used)

(f) FOX pattern

(g) MIC voice 64 k/s coded signal (only when MD0610B used)

(2) Control by send pattern CS (Clear to Send) or C

The send pattern can be switched between always send and send only when CS (or C) is ON.

(CS: V.24, V.35, V.36 interface unit,

C: X.20 /X.21 interface unit)

(3) CONTROL LINE send

Each interface CONTROL LINE ON/OFF/OPEN
(V.24, V.35, V.36, X.20/X.21 interface unit)

(4) Error insertion

Manual error: Single-bit error at key press or every second

CYCLIC error: 2.5×10^{-1} to 1.7×10^{-7}

($N \times 10^{-n}$, N: 1.0, 1.1, 1.3, 1.5, 1.7, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, n: 1 to 7)

(5) START/STOP bit length, data length, parity

(V.24, X.20, TTL interface)

STOP bit length: 1, 1.5, 2

START bit length: 1

Data length: 5, 6, 7, 8

Parity: None, odd, even

(6) SEND ALARM, AIS send (1.5 BPL, 2.0M BPL, 6.3M BPL, 8.4M BPL, 64k, 64k G.703, and 2.0M CMI interfaces)

SEND ALARM, AIS ON/OFF

2.2.4 Error measurement

(1) Measurement pattern

(a) A, Z, 1:1, 3:1, 1:3, 7:1, 1:7, 4:1, 1:4

*4:1 and 1:4 are not effective at start-stop sync 8 bit length/interface-with-frame time-slot/64 k and 64 k G.703 interface measurement

(b) Programmable pattern (5 to 8 bits at ST/SP, 5 bits at 2M BPL spare bits, other 8 bits)

(c) Pseudorandom pattern (polarity reversible 2^n-1 bit repetition, n: 6, 7, 9, 11, 15, 19, 20, 23)

(2) Error-measurement item

(a) Error count (Selected from bit error, code error, parity error, CRC error, frame no good, X.50 frame error)

(b) Error rate (Computed and displayed for every second, 1.0 to 1.0 x 10^{-20})

(c) Block error count (2^5 to 2^{16} or 10^1 to 10^6 bit block)

(d) Block error rate (Computed and displayed for every second, 1.0 to 1.0 x 10^{-20})

(e) ES (Computed-value display)

(f) %ES (Computed and displayed for every second)

(g) DM (Computed-value display)

(h) %DM (Computed and displayed for every minute)

(i) SES (Computed-value display)

(j) %SES (Computed and displayed for every second)

(k) US (Computed-value display)

(l) %US (Computed and displayed for every second)

(3) Measured results display

(a) Any three error-measurement items of (a) to (l) displayed simultaneously

(b) Buzzer sounds each time error detected (Adjustable volume)

(c) Elapsed time after measurement start constantly displayed in seconds

(4) Measurement time

(a) Manual START/STOP

(b) Setting by bit: 10^2 to 10^9 bit measurement

(c) Setting by time: 10 seconds to 999 hours 59 minutes 59 seconds (41 days) measurement

(d) Repetitive measurement by time: 10 seconds to 999 hours 59 minutes 59 seconds (41 days) cycle

2.2.5 Pattern trace function

This function traces patterns of up to 32 Kbyte and displays them as HEX, ASCII, EBCDIC, EBCDIK, or JIS8 code.

(a) Trace stop trigger

Selected from MANUAL, CODE, NOT CODE, CONTROL LINE ON/OFF, external input signal, and number of trace bytes

(b) Delayed trace after trigger detection

0 to 8000 bytes

2.2.6 Level measurement (only 64 kb/s when MD0610B used)

-90 dBm0 to +6 dBm0, μ-law, A-law.

2.2.7 Distortion measurement (when MD0610A used)

(1) Single-point distortion (only ≦64 kb/s)

Maximum value displayed

Measurement range: -49% to +49% (1% steps)
Accuracy: ≦±1%

(2) Bias distortion (only ≦64 kb/s)

Measurement patterns: 1:1, 4:1, 1:4

Measurement range: -100% to +100% (1% steps)

(3) Start-stop distortion (only ≦19200 b/s)

Maximum value displayed

Measurement range: -49% to +49% (1% steps)

Accuracy: ≦±1%

2.2.8 Voltage measurement

This function measures the DC voltage of each LINE

Measurement range: -30 to +30 V

Error: ±5% ±1 digit
of max. value of each range

Range: Autoranging of (a) to (c) below

(a) 0.01 to 1.99 V

(b) 2.0 to 19.9 V

(c) 20.0 to 30.0 V

2.2.9 Frequency measurement and counting

(1) Measurement signal

(a) Line (control, data, etc.) of each interface

(b) External input signal

(2) Measurement range

DC to 10 MHz

(3) Measurement accuracy

±10 ppm ±1 digit

(4) Display

Effective digits: seven decimal digits (Hz)

0 to 10,000.00 kHz (100 ms gate-time)

0 to 1,000,000 Hz (1 s gate-time)

0 to 100,000.0 Hz (10 s gate-time)

0 to 1,000,000 (MANUAL setting)

2.2.10 Time measurement

(1) Measurement signal

(a) Time between conversion points of signal

(b) Time between conversion points of external input signal

(c) Time from data send to return (delay-time measurement)

(2) Measurement range

0 to 10 seconds (10-µs steps, seven-decimal-digit display)

2.2.11 Signal monitor

(1) Monitor lamp

1 , ON: Green

0, OFF: Off

This function displays the signal line or receive data of each interface in 8-bit units.

(2) Monitor output

This function outputs the signal (line) of each interface at the monitor terminal of each unit.

2.2.12 Print output

(1) Printing at error measurement

(a) Printing at measurement start

At the measurement start, the time and set data are printed.

(b) Printing during measurement

The measured results and time are printed only if there is an error every second.

After the measurement start, the measured results and time can be printed manually.
The measured results and time are printed only if there is an error in each measurement cycle.

(c) Printing at measurement stop

At the measurement stop, the measured results and time are printed.

(d) Alarm data printer output

When pattern sync. loss, X.50 frame sync. loss, AIS alarm, frame sync. loss, or signal loss occurs, the data is printed (every second). The alarm data is also printed in modes set by an internal switch in which errors are not counted at pattern sync. loss.

P: Pattern sync. loss

X: X.50 frame sync. loss

A: AIS alarm

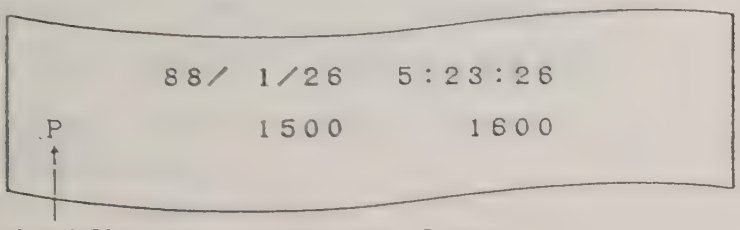
F: Frame sync. loss

I: Signal loss (*)

R: Signal loss recovered or printer paper-save function recovered

*For signal loss, the time is also printed once when signal loss occurs and once when the signal is recovered.

Example:



Signifies pattern sync. loss

(e) Printer paper-save function

(ON/OFF set by internal switch)

When errors are generated continuously for 10 seconds, the printer stops printing the data after 11 seconds (measurement continues).

When errors are not generated for 10 seconds, the printer recovers printing.

When [PRINT] is pressed to OFF and then back to ON while the printer is not printing, the stop state is cleared and printing is performed until the next stop-printing condition is generated.

(2) Printing information on each screen and measured results

The information on each screen and the measured results can be printed manually.

2.2.13 External input conditions

(1) EXT1

(a)	Connector	BNC
(b)	Input level	TTL or 0 dBm ±10 dB sine wave
(c)	Input contents	Slave synchronization 8 kHz clock or send external clock (50 Hz to 10 MHz)

(2) EXT2

(a)	Connector	I-214
(b)	Input level	0.5 to 2.0 Vo-p
(c)	Input contents	Slave synchronization (64 k + 8 k) clock

(3) EXTERNAL INPUT

(a)	Connector	BNC
(b)	Input level	TTL
(c)	Input contents	External input at measurements of frequency, count, and time interval between signals Word-trace external trigger

2.2.14 CLOCK OUTPUT

(a)	Connector	BNC
(b)	Output level	TTL
(c)	Output contents	Receive-gate clock or send 8-kHz clock (changed by internal switch)

2.2.15 ERROR OUTPUT

(a)	Connector	BNC
(b)	Output level	TTL
(c)	Output contents	Negative-logic RZ output at error generation (⌐⌊⌐)

2.2.16 Power consumption

<50 VA (Not including units)

2.2.17 Dimensions and weight

177 H x 284W x 351 D mm

(Not including cover, feet, handles, and power-cord winders)

Approx. 8.5 kg
(Not including units)

SECTION 3

OPERATION

3.1 Preparations

The MD6401A Data Transmission Analyzer is inspected throughly before shipment. When it is received, first inspect the box for damage and unpack the instrument. After unpacking, inspect the main frame and check the number and type of accessories.

If the instrument has been damaged during shipment, contact Anritsu.

3.1.1 Measurement environment and safety check

(1) This instrument operates normally at ambient temperatures of 0° to 50°C. However, do not use it:

(1) Where vibration is severe

(2) Where the humidity is high

(3) Where dust is prevalent

(4) Where it will be in direct sunlight.

To ensure that the instrument operates normally for a long time, it should be used at room temperature, as well as according to the conditions above.

(2) This instrument operates on 85 to 132/170 to 250 Vac (switched internally), 47 to 63 Hz power.

Always check the voltage setting before connecting the instrument to the power line. Also, check that the instrument POWER switch is set to OFF before connecting the power cord. Always ground the frame-ground terminal to avoid electric shock.

3.1.2 Factory settings of internal switches

The factory settings of the internal switches A5-S1 and A1-S1 are shown below. The internal switches are explained in paragraph 3.1.3.

Table 3-1 Factory Settings of Internal Switches

Switch		Setting item	Factory setting
A5-S1	1	————	OFF
	2	————	ON
	3	————	ON
	4	Si bit when MD0603A used	ON
	5	————	ON
	6	Printer paper-save function	ON
	7	SES and US threshold values	ON
	8	Error count at pattern sync. loss	ON
A1-S1		CLOCK OUTPUT switching	R-CLK

3.1.3 Setting internal switches

The condition setting switches (A1-S1, A5-S1) inside the MD6401A main frame are explained below. The positions of the internal switches are shown in Fig. 3-2.

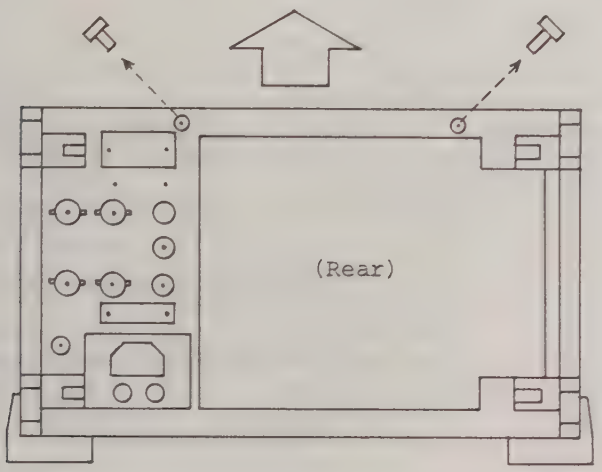


Fig. 3-1 MD6401A Main-Frame Top Cover Removal

Remove the two screws at the rear and remove the top cover in the direction of the arrow shown in Fig. 3-1.

The internal switches A1-S1 and A5-S1 will be seen as shown in Fig. 3-2.

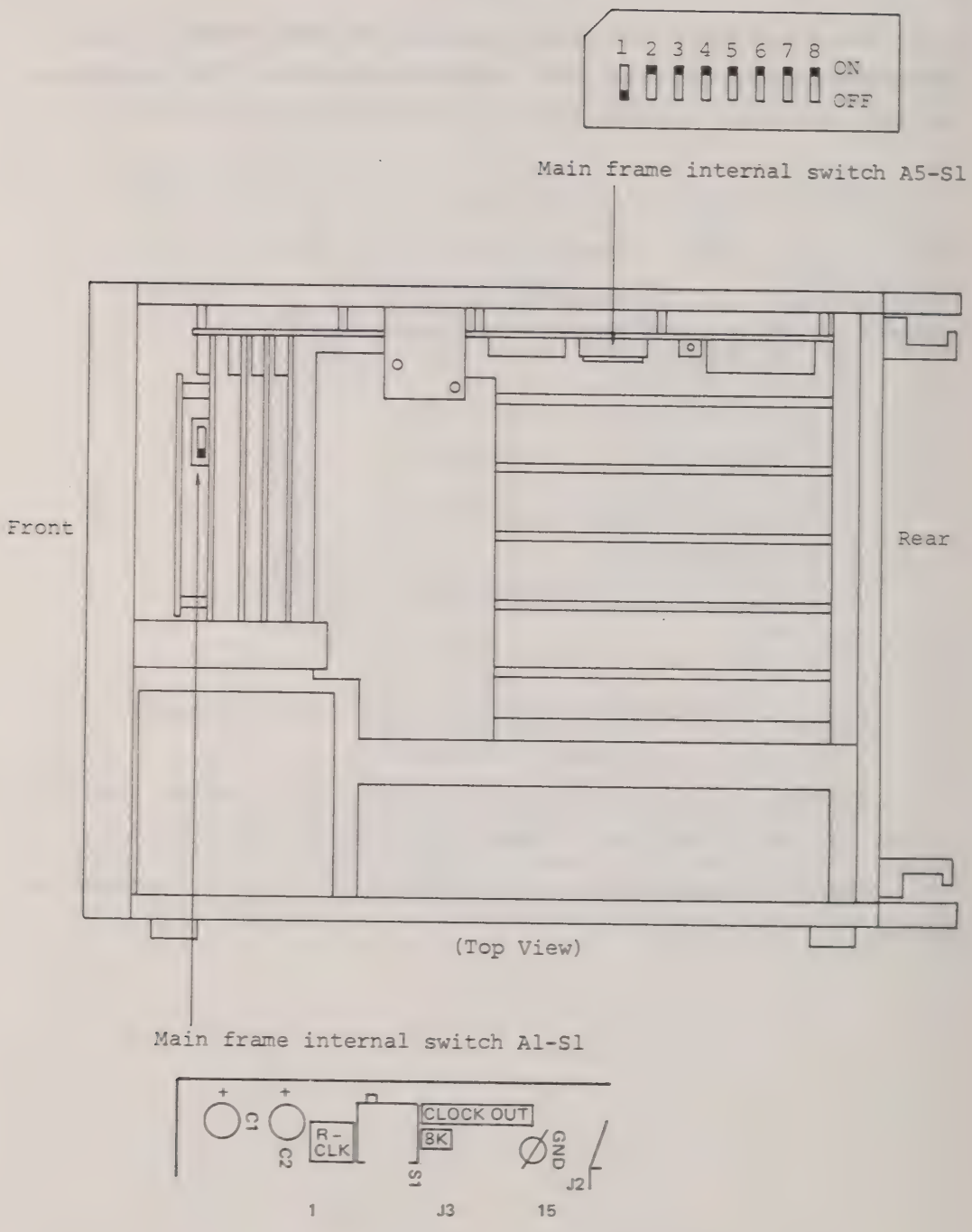


Fig. 3-2 Internal Switch Positions (A1-S1, A5-S1)

(1) Explanation of main frame internal switch A5-S1

Table 3-2

No.	Function	Explanation
1	———	Always OFF
2	———	Always ON
3	———	Always ON
4	FRAME 16MFP1, 2 and 2MFP1, 2 Si-bit setting when MD0603A Bipolar Unit used	ON .... Si bit 1 OFF ... Si bit 0
5	———	Always ON
6	Printer paper-save function setting	ON .... Always prints OFF ... Enables printer paper-save function * The printer paper-save function stops printing error data after the 11 seconds when errors are generated for 10 consecutive seconds during error measurement. When errors are not detected for another 10 consecutive seconds, printing resumes.
7	SES and US threshold value setting	ON .... SES, US threshold 10^{-3} OFF ... SES, US threshold 10^{-4}
8	Error count execution at pattern sync. loss	ON .... Always count errors OFF ... Does not count errors generated at pattern sync loss.

The internal switch A5-S1 setting status is fetched at power-on or initial setting, so any status that is set after power-on or initial setting is ignored.

Therefore, to change the status, turn off the power or perform initial setting.

(2) Explanation of main frame internal switch A1-S1

This switch switches the signal output from the main frame rear-panel CLOCK OUTPUT connector.

[R-CLK] ... Outputs receive gate clock

[8K] ..... Outputs send 8 k clock

3.2 Explanation of Controls

The front-panel layout is shown in Fig. 3-3 and the rear-panel layout is shown in Fig. 3-4.

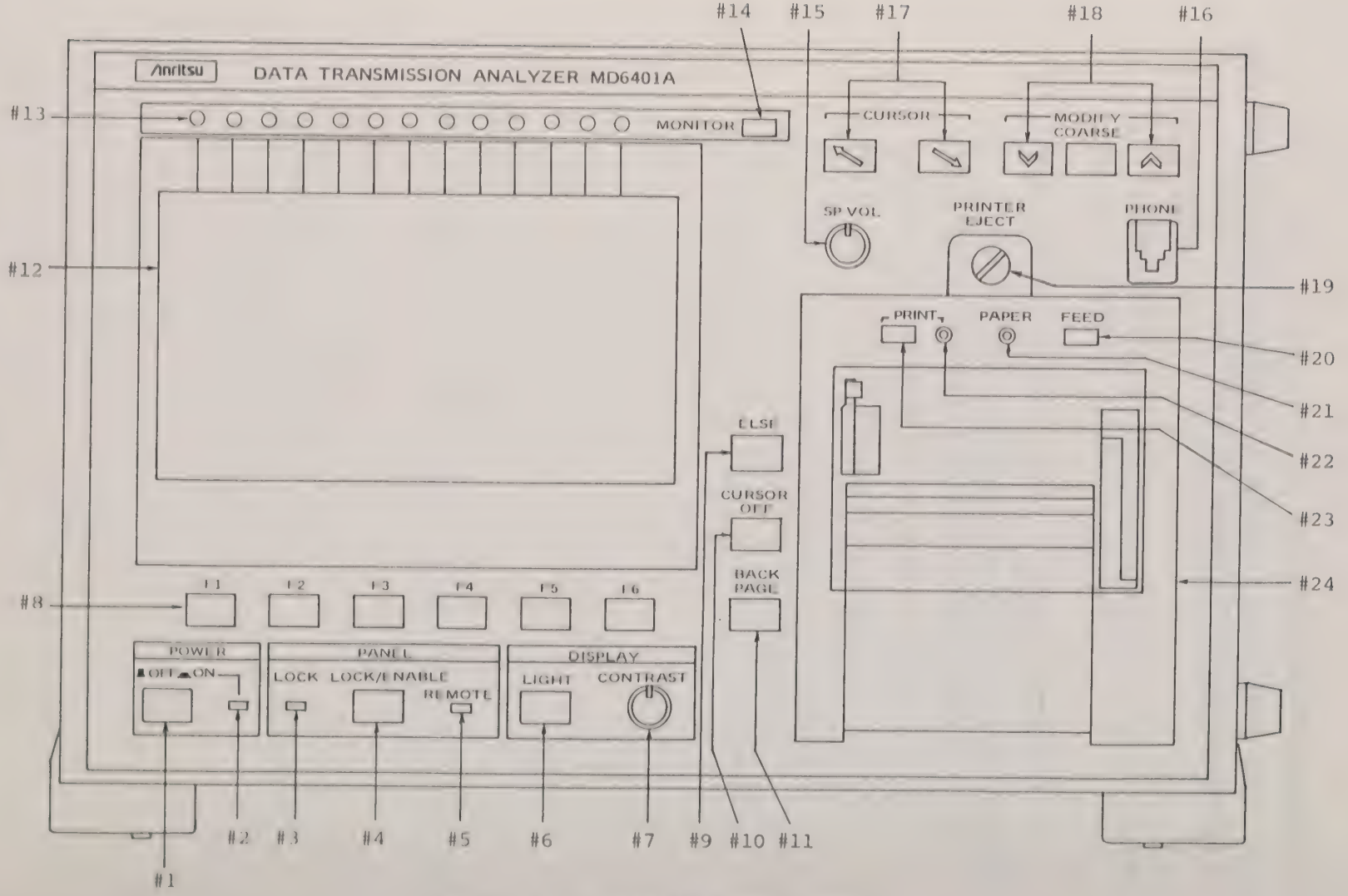


Fig. 3-3 MD6401A Front Panel

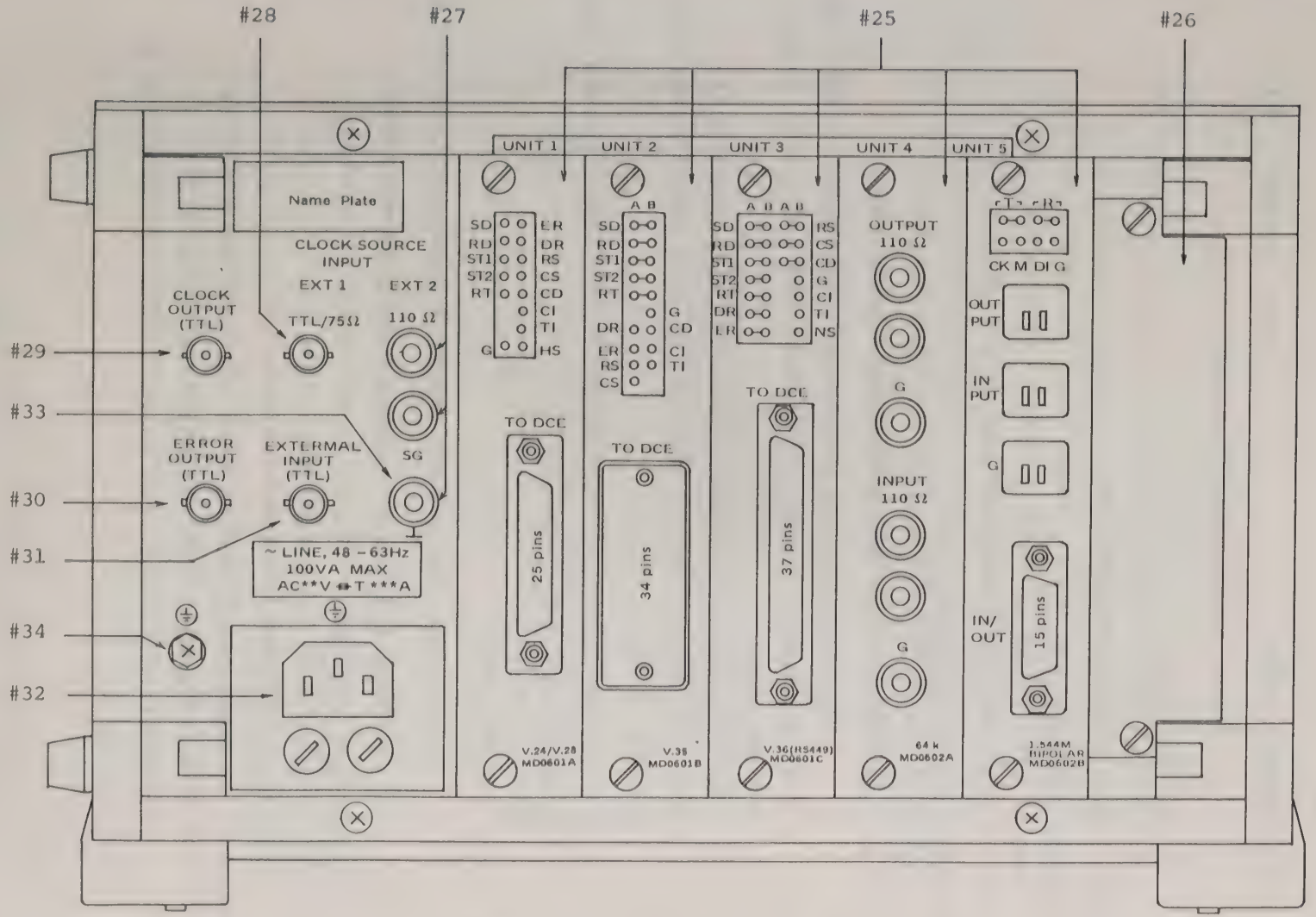


Fig. 3-4 MD6401A Rear Panel

#1 POWER switch

Power supply ON/OFF switch

#2 POWER lamp

Lit when power on

#3 LOCK lamp

Lit when panel locked

#4 [LOCK/ENABLE] key

Panel LOCK and ENABLE changeover key

When this key is pressed in the ENABLE state, the status changes to the LOCK state and the panel cannot be operated.
(At this time, the LOCK lamp is lit.) When this key is pressed in the LOCK state, the panel enters the ENABLE state.

When this key is pressed in the REMOTE state, the panel can be operated.

#5 REMOTE lamp

Lit when controlled remotely by RS-232C or GP-IB

At this time, the panel cannot be operated.

#6 [LIGHT] key

LCD backlight switch

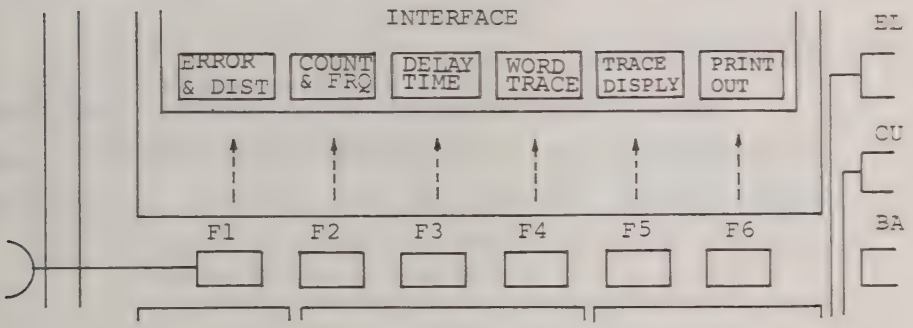
The backlighting goes off when this key is pressed again. The backlighting goes off automatically when the panel is not operated for 30 minutes.

#7 CONTRAST knob

Adjusts display contrast

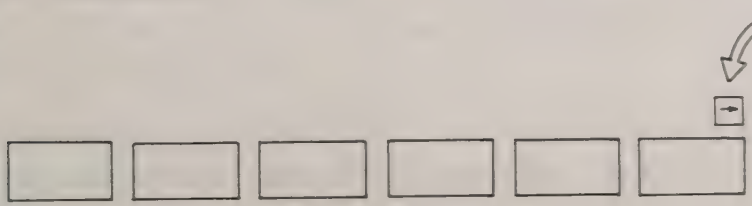
#8 Menu selection soft keys (F1 to F6)

These keys are used to set the menu displayed on the bottom of the display. The contents of the menu differ with the screen, whether or not the cursor is displayed, and the cursor position. When the cursor is ON, these indicate the selectable item's values or contents. When the cursor is OFF, these indicate the selectable functions with the selected items on the screen.



#9 [ELSE] key

There are six menu selection items. When all the items cannot be displayed at one time, the next six items are displayed by pressing this key. When all the items have been displayed, operation returns to the initial menu. When there are more than six menu items, an arrow is displayed at the top-right side of the menu.



#10 [CURSOR OFF] key

When this key is pressed when a cursor is displayed on the screen (cursor position reverse-displayed), the cursor goes off.

#11 [BACK PAGE] key

Returns screen to upper rank screen

#12 Display

Displays set contents, measured results, and menu

The display contrast is adjusted by the CONTRAST knob #7 and backlighting is set with [LIGHT] #6.

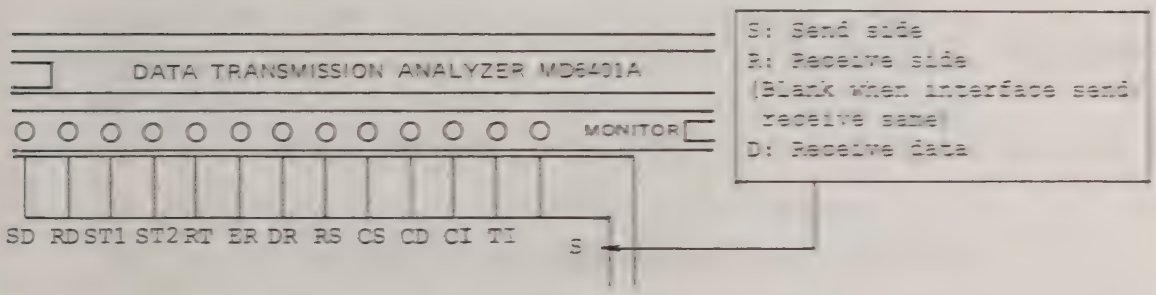
#13 MONITOR lamps

These lamps monitor the signals. The lamp corresponding to each control line and data line displayed at the top of the display, is lit when the control line is "ON" or the data line is "1".

	Lit	Not lit
Control line	ON	OFF
Data line	1	0

#14 [MONITOR] key

Changes monitoring signal line (send side/ receive side/receive data)
The signal line currently being monitored is indicated at the top right of the display with an S, R, or D mark.


DATA TRANSMISSION ANALYZER MD6401A
MONITOR
SD RD ST1 ST2 RT ER DR RS CS CD CI TI
S
S: Send side
R: Receive side
(Blank when interface send receive same)
D: Receive data

#15 SP VOL knob

Speaker volume knob

#16 PHONE

Connector for headset

#17 [CURSOR] keys [↖] [↘]

Shifts cursor

For the shift direction, the [↖] key moves the cursor left upward and the [↘] key moves it right downward. If the [↖] key is pressed when the cursor is in the top-left corner, or if the [↘] key is pressed when the cursor is in bottom-right corner, the cursor will go out. If the [↘] key is pressed when the cursor is out, the cursor will appear in the bottom-right corner; if the [↖] is pressed, the cursor will appear in the top-left corner.

Paragraph 3.4 describes the measurement screens for details on the cursor's direction, shift place, and item contents.

#18 [MODIFY] key ([∨], [COARSE], [∧])

These keys are used to change the contents or value of the item specified by the cursor.

When the item value is a digital value in certain steps between the minimum and maximum values, when the [∧] is pressed once, the value becomes one step larger. When the [∧] is pressed while holding down the [COARSE], it becomes 10 steps larger. After the maximum value is reached, operation returns to the minimum value. [∨] has a reverse operations to [∧].

[COARSE] also functions as the zero-clear at clock setting (paragraph 3.4.2 (2)).

#19 PRINTER EJECT

Used to pull out and lock printer when changing printer paper

#20 [FEED] key

Feeds printer paper

This key also operates when the printer function is off (when the PRINT lamp #22 is off).

#21 PAPER lamp

Lights when printer paper finished

#22 PRINT lamp

Lights when printer enabled

♯23 [PRINT] key

ON/OFF switch for printer

♯24 Printer

Prints measurement items and measured data

♯25 Unit insertion slot

Accepts each interface unit or function extension unit

The insertion position is not restricted for a unit.

♯26 Remote-control-unit insertion slot

Accepts RS-232C or GP-IB remote control unit

♯27 EXT2 (110 Ω)

These are (64 k + 8 k) signal input plugs for when the internal generation clocks are subordinate to (64 k + 8 k).

♯28 EXT1 (TTL/75 Ω)

. This is an 8 kHz (TTL) signal input plug for when the internal generation clock is subordinate to 8 kHz.

. This is a clock input plug (TTL or 75 Ω selectable) for when the external input clock is used as a send clock.

#29 CLOCK OUTPUT (TTL)

Synchronizes 8 kHz clock output plug (changed by internal switch) with receive gate clock or send internal generation clock

#30 ERROR OUTPUT (TTL)

Error output plug

#31 EXTERNAL INPUT (TTL)

. Input plug when counting and measuring frequency of external input signal

. External input plug for measuring time between signals

. External input plug for trace stop trigger at pattern tracing

#32 AC ** V, *** A

AC ** V input and *** A fuse holders

#33 SG

Signal ground

#34 FG

Frame ground

3.3 Explanation of Screen Display

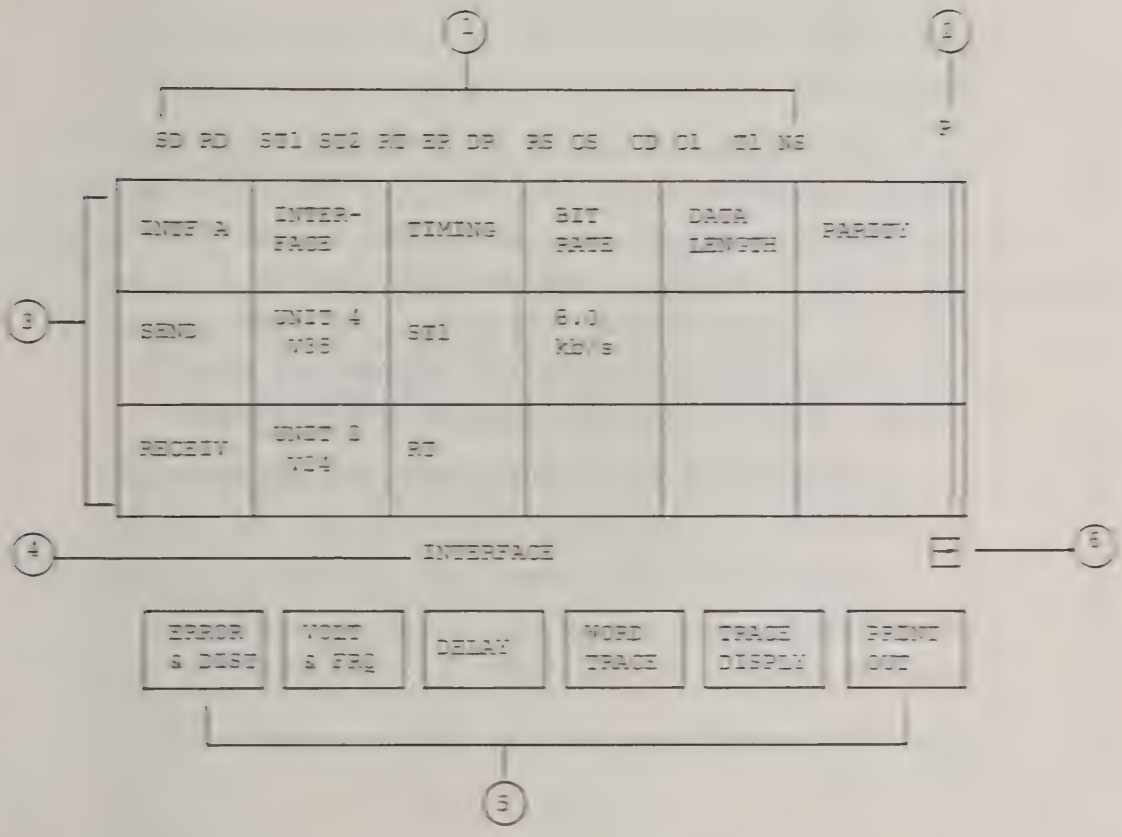


Fig. 3-5 Screen Explanation

① Monitor line

Displays name of line being monitored

With this instrument, the signal line (receive-unit line, send-unit line, or receive data) can be monitored.

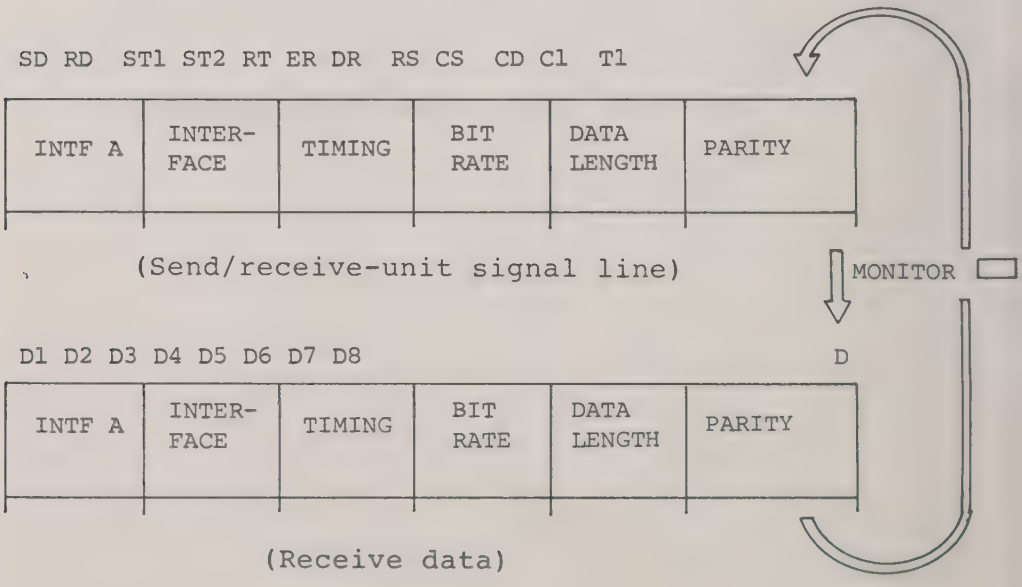
The monitored signal line (control and data lines) is switched by [MONITOR] at the top-right of the screen. Whether the displayed signal line is the send-unit line (S), receive-unit line (R), or receive data (D) is displayed on the monitor status display ②. When the send-unit is the same as the receive-unit, the marks S and R are blanked.

The monitor data-line names are common to all interfaces.

The control-line names are different for each interface.

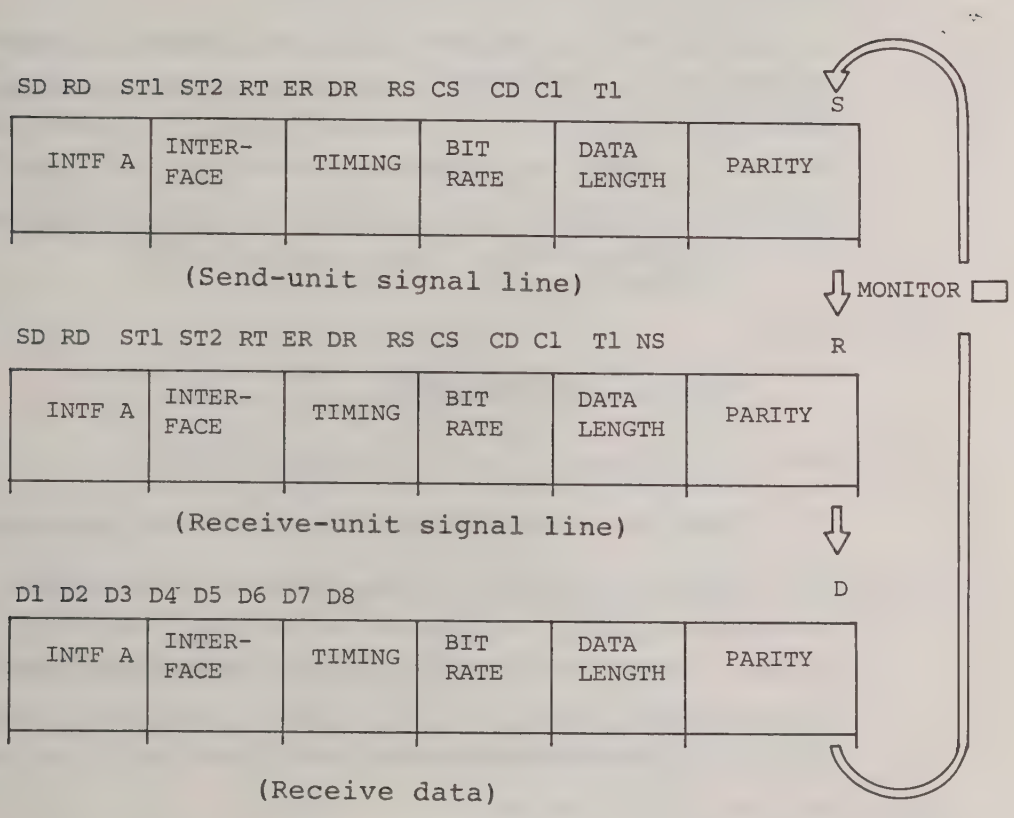
Example 1:

When send unit same as receive unit



Example 2:

When send unit differs from receive unit



② Monitor status display

Displays whether monitor line ① is send-unit signal line, receive-unit signal line, or receive data

S: Send-unit signal line

R: Receive-unit signal line

D: Receive data

S and R becomes blank when the send unit is the same as the receive unit.

③ Main screen

Displays setting item's contents/value and measured results for each screen

The display contents are different for each screen (MODE, INTERFACE, and measurement screens). Since the cursor (reverse-displayed) is displayed on the main screen by pressing the CURSOR [↖] or [↘], move the cursor to the item to be set and set the item's contents/value using the menu ⑤.

④ Title

Displays screen name

⑤ Menu

Displays menu contents by reversed characters

When the cursor is ON, these indicate the selectable item's value or contents. When the cursor is OFF, these indicate the selectable functions with the selected items on the screen. The menu items correspond to the menu keys ([F1] to [F6]) at the bottom of the screen.

⑥ Hidden menu present/not-present display

When there are six or more items in the menu, a → symbol is displayed. Undisplayed menu items can be displayed by using [ELSE] at the right side of the screen.

3.4 Operation

3.4.1 Screen hierarchy

The hierarchy of the MD6401A screen is shown below.

It has two sets of screens (INTF A and INTF B).
Measurements are made according to each screen.

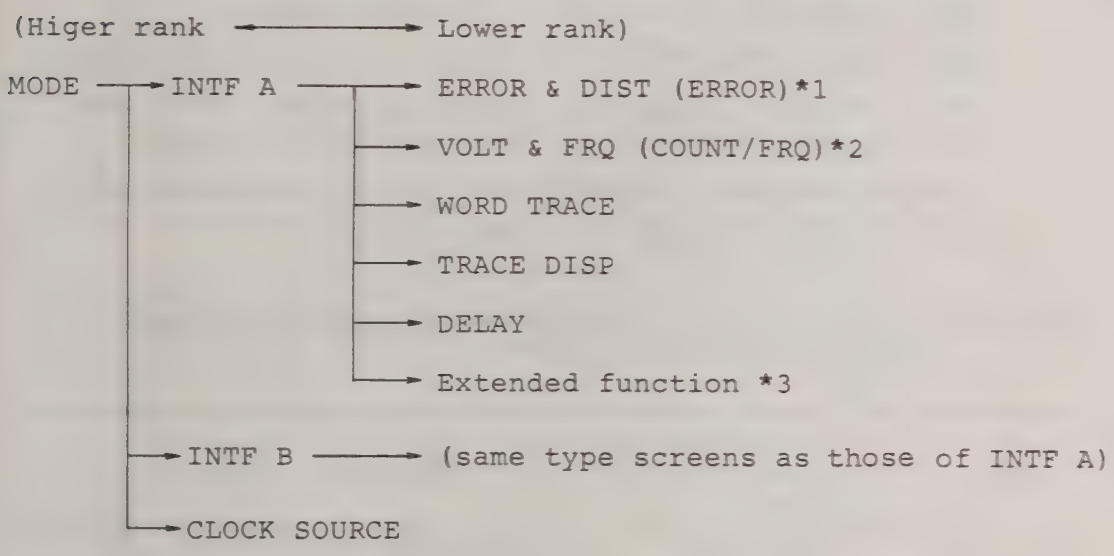


Fig. 3-6 Screen Hierarchy

*1 The ERROR & DIST screen is effective only when the MD0601A (V.24/V.28), MD0601B (V.35), MD0601C (V.36), MD0601D (X.20/X.21) or MD0606A (TTL) interface unit is used for receiving and the MD0610A (DIST) function extension unit is added.

When other interface units are used, or when the interface units above are used and a function extension unit is not used, or when the interface units above are used for sending only, this screen becomes the ERROR screen only and DISTORTION measurement cannot be made.

*2 The VOLT & FRQ screen is effective when the MD0601A (V.24/V.28), MD0601B (V.35), MD0601C (V.36), or MD0601D (X.20/X.21) interface unit is used. Other interface units do not perform VOLT measurement and VOLT & FRQ screen becomes the COUNT & FRQ screen.

*3 The extended function screen appears for the unit when the MD0607A (ANALOG), MD0610B (CODEC), MD0611A/B/C/D (INF-TEST), or other function extension unit is used. Depending on the interface unit used, some function extension units may not be usable. The relationship between the function extension units and interface units is shown below.

Table 3-3 Relationship Between Function Extension Units and Interface Units

Screen	Function extension unit	Interface unit
ANALOG	MD0607A	All units
CODEC	MD0610B	MD0602A/B/E, MD0603A/A1, MD0604A/B/C
INF-TEST (V.24/V.28)	MD0611A	MD0601A
INF-TEST (V.35)	MD0611B	MD0601B
INF-TEST (V.36)	MD0611C	MD0601C
INF-TEST (X.20/X.21)	MD0611D	MD0601D

3.4.2 MODE screen

The MODE screen is the initial screen at power-on.

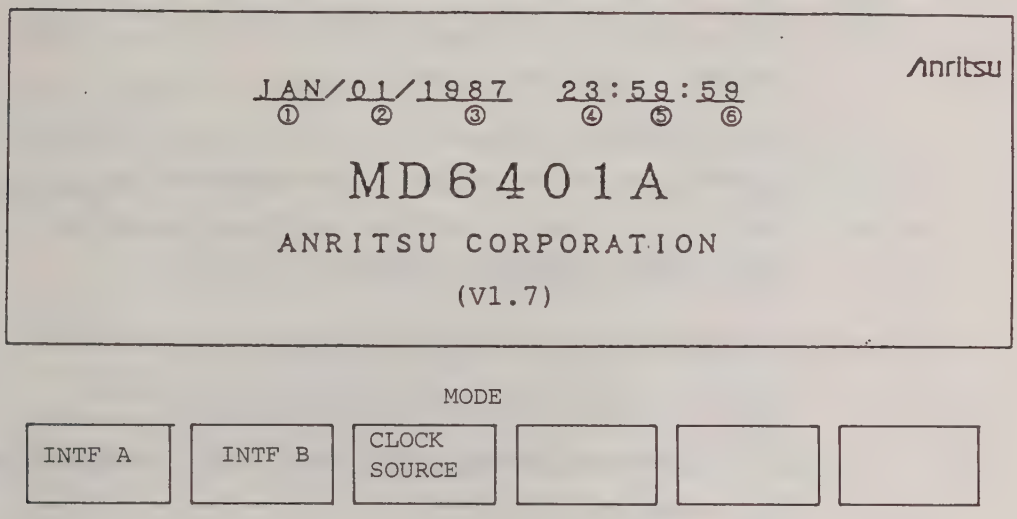


Fig. 3-7 MODE Screen

(1) Selecting function menu

The MODE screen menu is shown below.

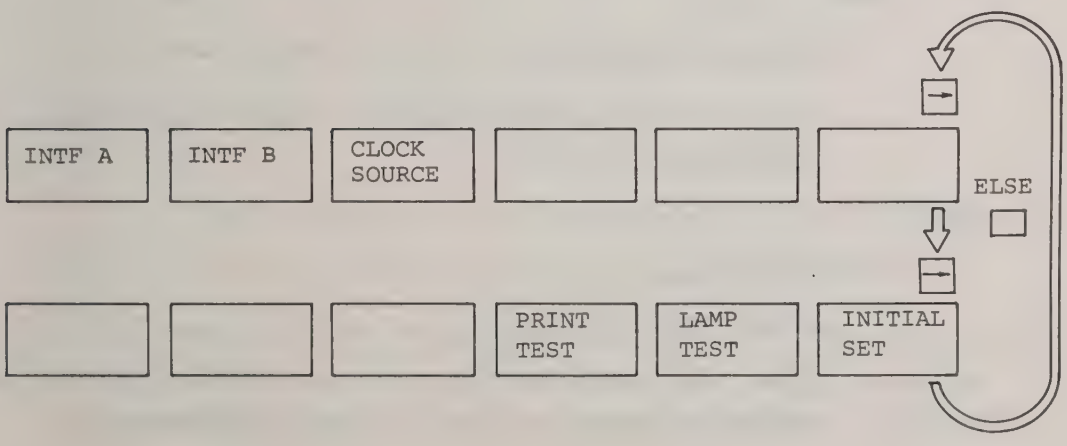


Fig. 3-8 MODE-Screen Function Menu

The MODE screen menu is explained below.

[INTF A]/[INTF B]:

INTERFACE screen changeover key

The screen is changed to the INTF A or INTF B screen by pressing this key.

The INTERFACE screen is used to select the send/receive interface unit used for measurement and to set the interface send and receive conditions (paragraph 3.4.3).

[CLOCK SOURCE]:

CLOCK SOURCE screen changeover key

The screen is changed to the CLOCK SOURCE screen by pressing this key.

The CLOCK SOURCE screen is used to specify the standard frequency of the send internal clock, to specify the byte phase at 64 kb/s, and to specify the interface of the external input clock at external clock operation (paragraph 3.4.5).

[PRINT TEST]:

Printer test key

This key tests the built-in printer printing (paragraph 3.5.1).

[LAMP TEST]:

Lamp test key

This key tests the front-panel LOCK, REMOTE, and MONITOR lamps and the LCD panel (paragraph 5.2.1).

[INITIAL SET]:

Initial set key

This key returns all the currently-set contents to the initial state.

(2) Time Setting

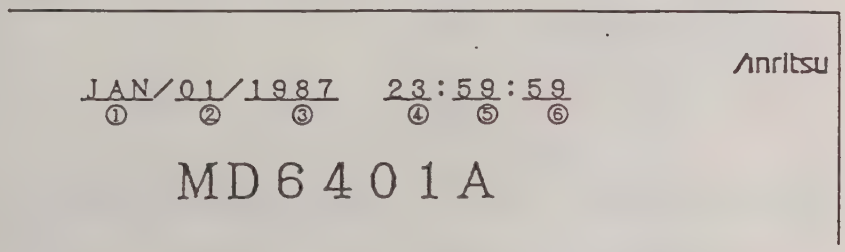


Fig. 3-9 Time Display

Step	Procedure
1	Press the CURSOR [↘] or [↖] once; ① or ⑥ is reverse-displayed. Move the cursor to the desired setting item position by pressing the key.
2	Next, set the item value by using MODIFY [∨] or [∧]. Note: The setting can be cleared with MODIFY [COARSE].
3	Set the time by repeating steps 1 and 2.
4	Turn off the reverse-display to complete the time setting by pressing [CURSOR OFF] or by pressing CURSOR [↖] or [↘] to move the cursor outside ① or ⑥.

The setting ranges are shown below;

① Month: JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC

② Day: 1 to 31

③ Year: 1986 to 2085

④ Hour: 0 to 23

⑤ Minute: 0 to 59

⑥ Second: 0 to 59

The internal clock of the MD6401A runs during time setting, but is stopped while the cursor is at the second position ⑥. The clock restarts when the cursor is moved from ⑥.

The clock continues to run on the back-up battery even when the power is off.

3.4.3 INTERFACE screen

When [INTF A] or [INTF B] is selected at the MODE screen (paragraph 3.4.2), the INTERFACE screen appears.

SD RD ST1 ST2 RT ER DR RS CS CD C1 T1 NS R

INTF A	INTER-FACE	TIMING	BIT RATE	DATA LENGTH	PARITY
SEND	UNIT 4 V35	ST1	8.0 kb/s		
RECEIV	UNIT 2 V24	RT			

INTERFACE

[ERROR & DIST] [VOLT & FRQ] [DELAY] [WORD TRACE] [TRACE DISPLY] [PRINT OUT]

Fig. 3-10 INTERFACE Screen

(1) Selecting function menu

[ERROR & DIST]:

Selects ERROR/DIST screen

Error and distortion are measured at the ERROR/ DIST screen (paragraphs 3.4.1 *1 and 3.4.4(1)).

[VOLT & FRQ]:

Selects VOLT/FREQUENCY screen

The voltage and frequency of each signal line at the receive side are measured at the VOLT/ FREQUENCY screen (paragraphs 3.4.1 *2 and 3.4.4 (2)).

[DELAY]:

Selects DELAY screen

The time between two conversion points of one signal line or two different signal lines, and transmission delay time are measured at the DELAY screen (paragraph 3.4.4 (3)).

[WORD TRACE]:

Selects WORD TRACE screen

The send pattern setting and received data are traced at the WORD TRACE screen (paragraph 3.4.4 (4)).

[TRACE DISPLY]:

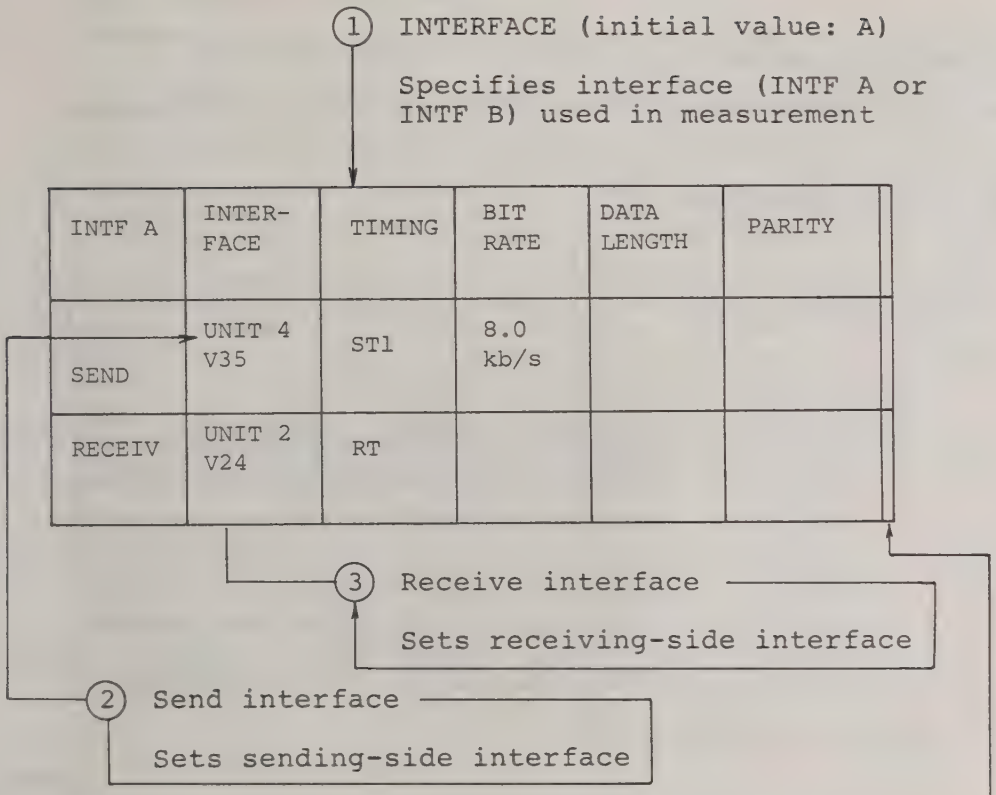
Selects TRACE DISPLAY screen

The results of the data trace performed at the WORD TRACE screen are displayed on the TRACE DISPLAY screen (paragraph 3.4.4 (5)).

[PRINT OUT]:

Prints INTERFACE screen settings (paragraph 3.5)

(2) Selecting item menu

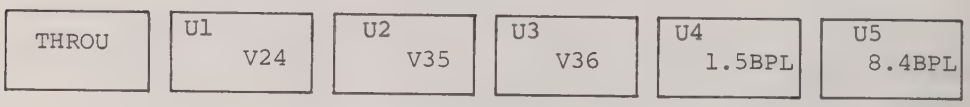


When setting items run off the right side of the screen, a bold line appears at the right side. In this case, move the cursor at the right side of the screen to scroll the screen horizontally, then the remaining items can be viewed. When it is displayed to the end of the setting items, the bold line become white skip.

Fig. 3-11 INTERFACE-Screen Items

① INTERFACE

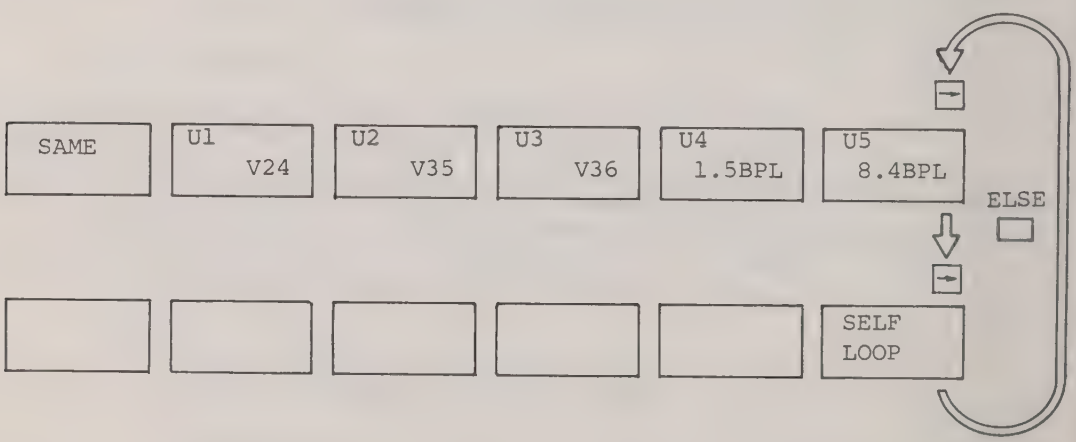
② Send interface



[THROU]: Used when sending receive-data straight through (MD0602B/D, MD0603A/B, and MD0604A/B/C/D/E units can use this item.)

[U1] to [U5]: Displays all the interface units inserted in main frame (U means unit)

③ Receive interface



[SAME]: Makes receive-unit settings same as send-unit settings

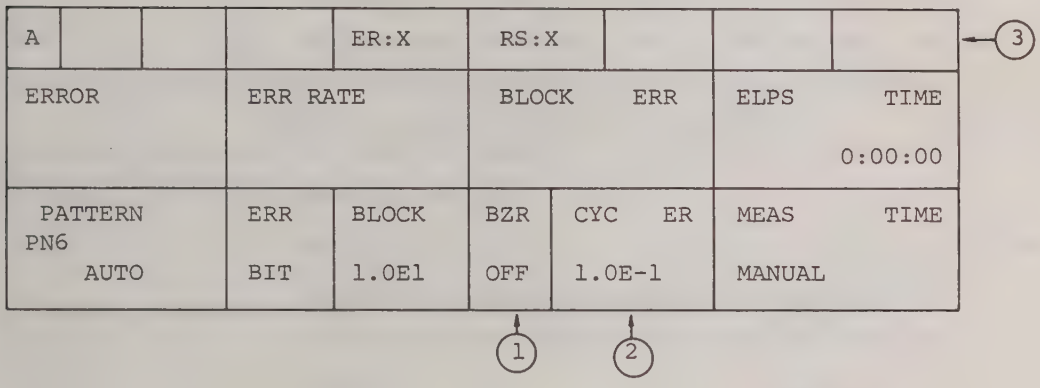
[SELF LOOP]: Loops-back sending and receiving inside interface unit

3.4.4 Measurement screen

(1) ERROR/DISTORTION

When [ERROR & DIST] is selected from the function menu on the INTERFACE screen (paragraph 3.4.3), the ERROR/DISTORTION screen is displayed.

SD RD ST1 ST2 RT ER DR RS CS CD CI TI ← In case of V.35



ERROR/DISTORTION

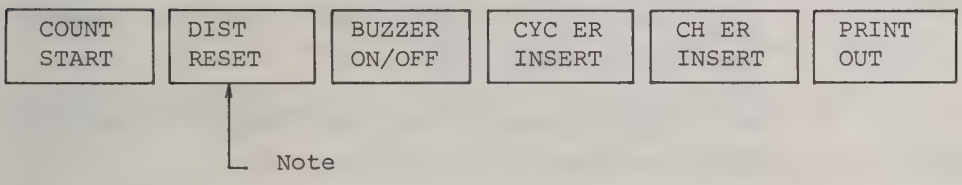


Fig. 3-12 ERROR/DISTORTION Screen (V.35)

Note:

Displayed only when MD0610A DIST unit installed

(a) Selecting function menu

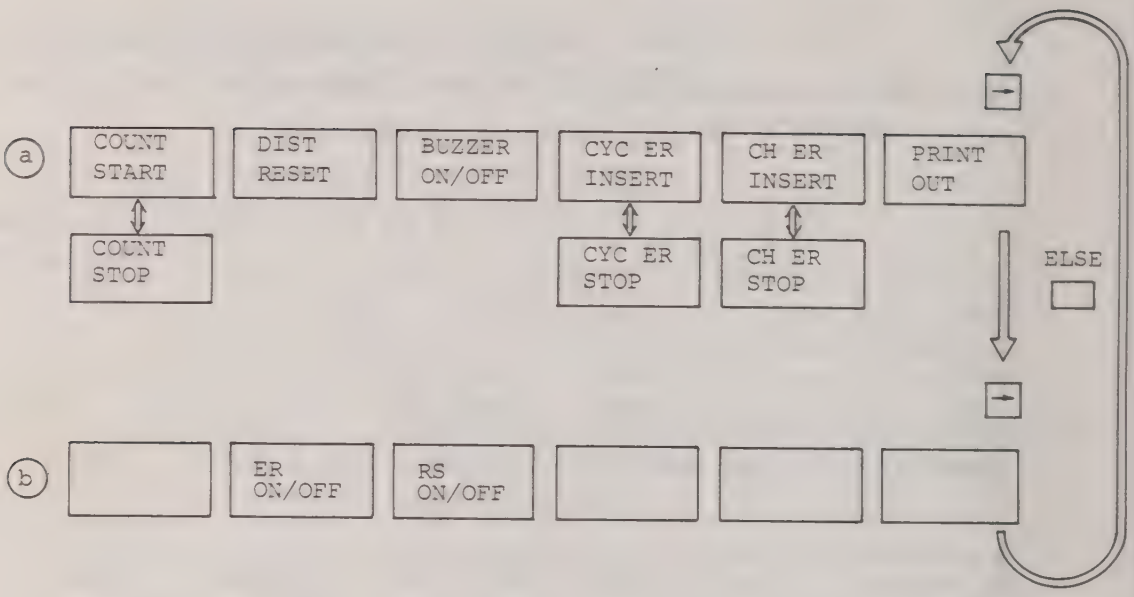


Fig. 3-13 ERROR/DISTORTION-Screen Function Menu

Notes:

1. Menu (b) varies with interface unit.
   For details, refer to the operation manual for each interface unit.
2. Menu (b) appears when the control line is ON (↑) or OFF (↓).

   For OPEN(X), only menu (a) is displayed.

[COUNT START]: Measurement start/stop key

The cursor is reset and measurement starts when [COUNT START] is pressed. During measurement stop, [COUNT START] is displayed.

[COUNT STOP]

[COUNT START] changes to [COUNT STOP] at the measurement start.

Measurement is ended by pressing [COUNT STOP]. At this time, the key changes from [COUNT STOP] to [COUNT START] and the instrument enters the measure-ready state.

[DIST RESET]: DISTORTION reset key

This key is used to clear the single-point distortion and start-stop distortion measured value. This key is displayed only when the DIST unit (MD0610A) is used. It is not displayed when the DIST unit is not used.

[BUZZER ON/OFF]: Buzzer ON/OFF setting key

When an error is detected, a buzzer can be sounded. The buzzer setting status is displayed at the BZR item (1) on the screen.

It is switched ON/OFF each time this key is pressed. The volume can be adjusted with SP VOL knob on the front panel.

[CYC ER INSERT]: Cyclic error insertion/stop key

To generate a cyclic error at the sending side, a cyclic error is inserted by pressing this key with the rate displayed at the CYC ER item (2) on the screen.

[CYC ER STOP] In the uninserted status, [CYC ER INSERT] is displayed.
After insertion, this [CYC ER INSERT] changes to [CYC ER STOP]. Error insertion is stopped by pressing [CYC ER STOP].

At this time, [CYC ER STOP] changes to [CYC ER INSERT] and ERROR insertion ends.

[CH ER INSERT]: CH ERROR insert key

[CH ER STOP]

When a single error is inserted at the sending side, one error is inserted each time this key is pushed. At this time, the key remains [CH ER INSERT].

When this key is held down for one second or longer, the mode automatically changes to the mode which inserts one error every second and the key changes to [CH ER STOP]. Error insertion is stopped by pressing [CH ER STOP].

At this time, the [CH ER STOP] changes to [CH ER INSERT] and error insertion stops.

[PRINT OUT]: Printer output key

Press this key to output measured results to the printer.

For print examples, refer to paragraph 3.5.

[ER ON/OFF]/
[RS ON/OFF]: Control-line ON (↑)/OFF (↓) changeover key

When the control-line setting displayed on the control-line item ③ on the screen is ON (↑) or OFF (↓), this menu is displayed.

The control line changes ON (↑)/OFF (↓) each time this key is pressed, and the set state is displayed at the control-line item ③ on the screen.

(b) Selecting item menu

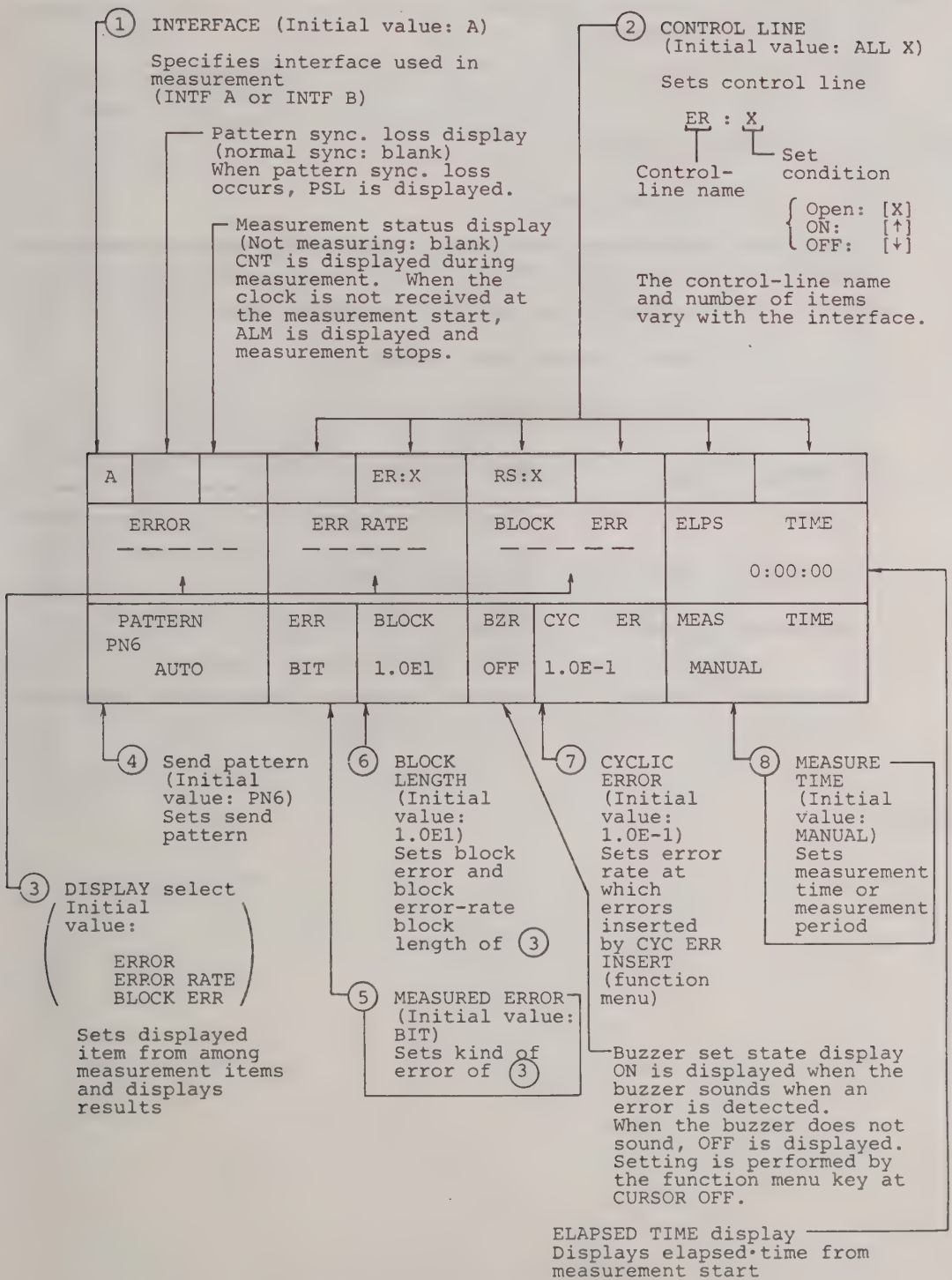


Fig. 3-14 ERROR/DISTORTION-Screen Items

① INTERFACE

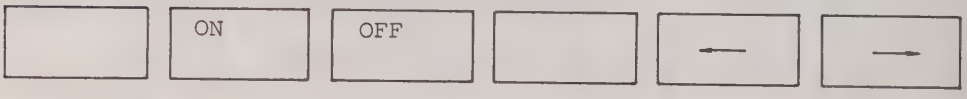
② CONTROL LINE

(i) MD0601A/B/C/D

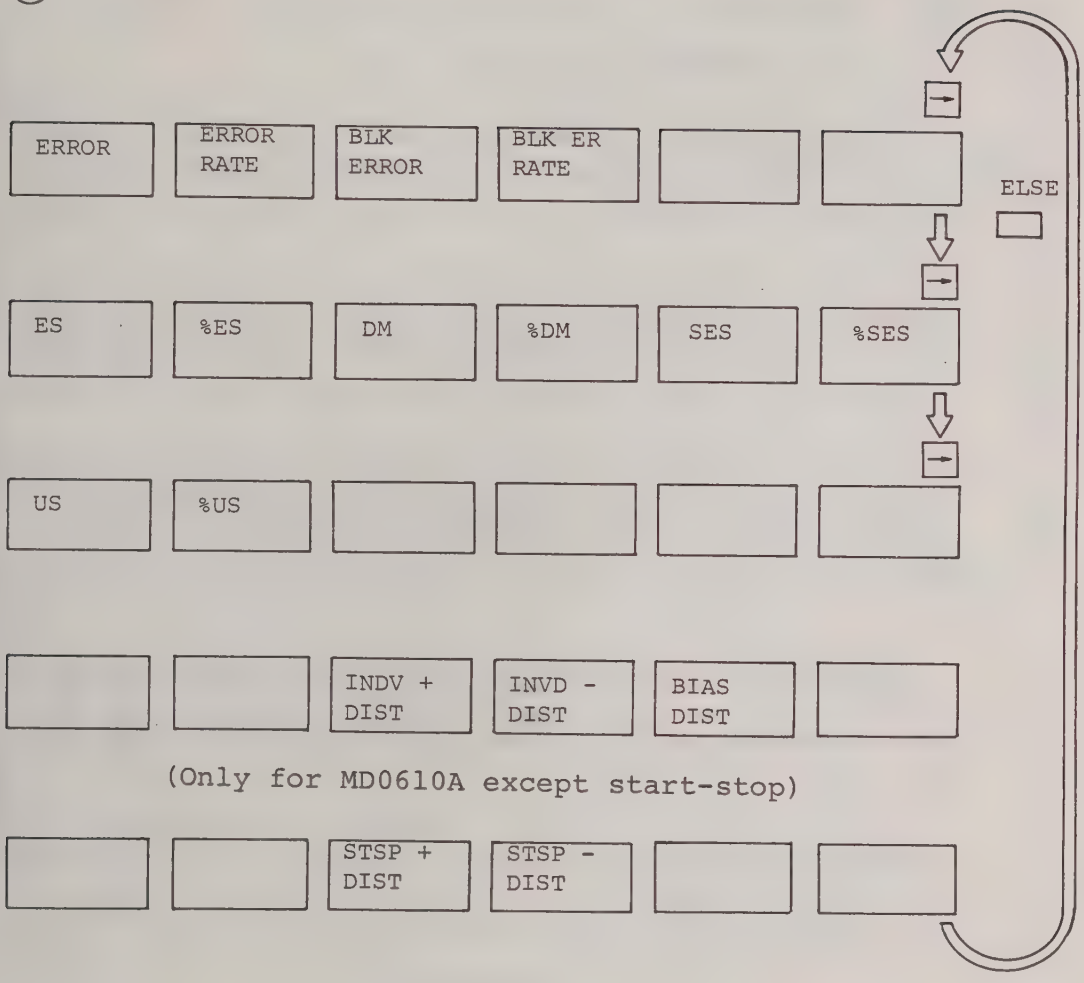
(ii) Other interface units

1) SEND THROU

2) Other than SEND THROU.

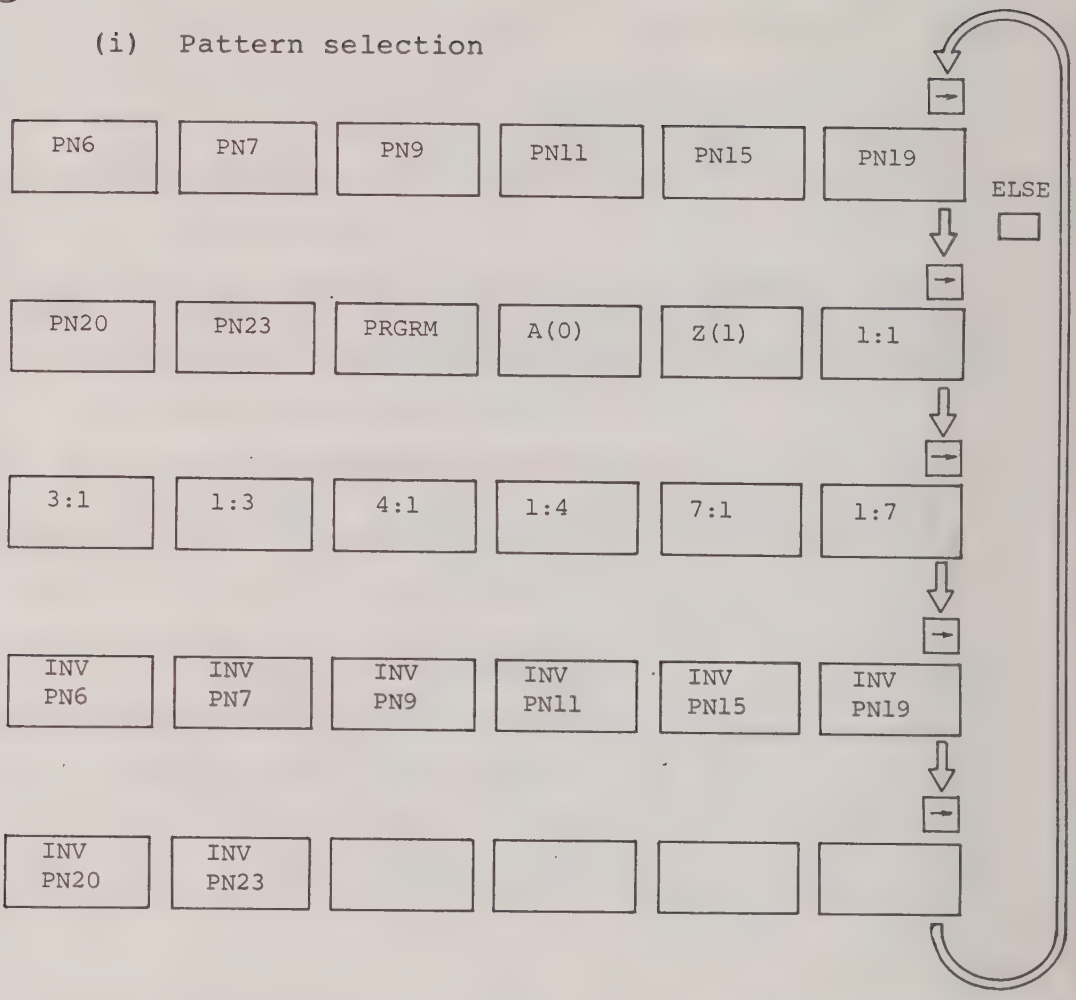


③ DISPLAY select



④ PATTERN

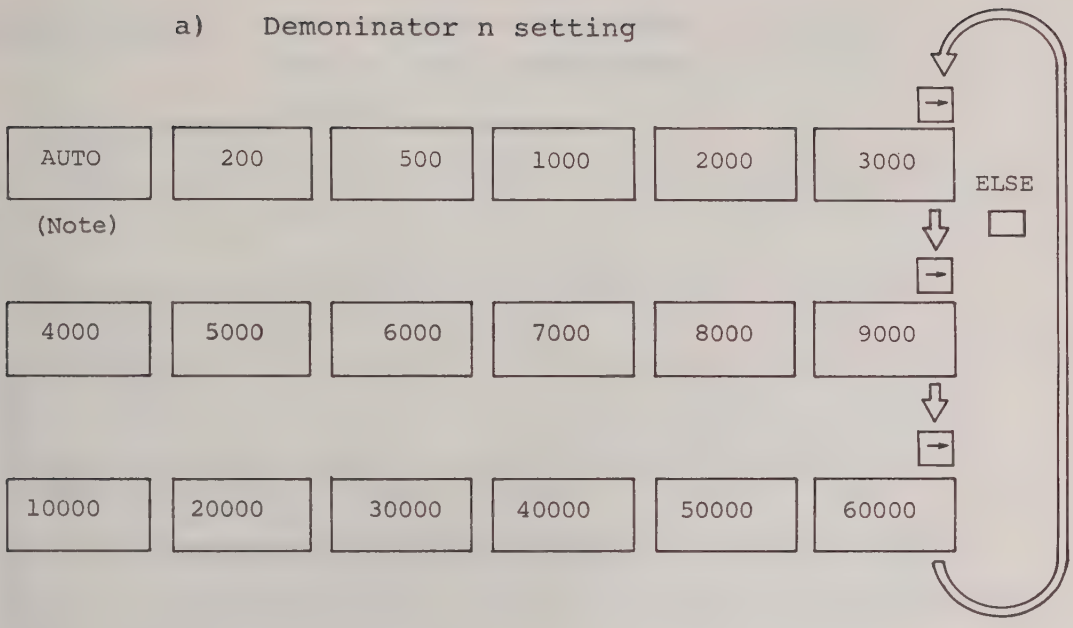
(i) Pattern selection



(ii) PN-pattern sync.-loss detection condition setting (threshold-value m/n setting)

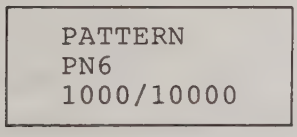
1) Patterns of PN6, 7, 9, 11, 15, 19, 20, 23, and INV PN6, 7, 9, 11, 15, 19, 20, 23

a) Demoninator n setting



Note:

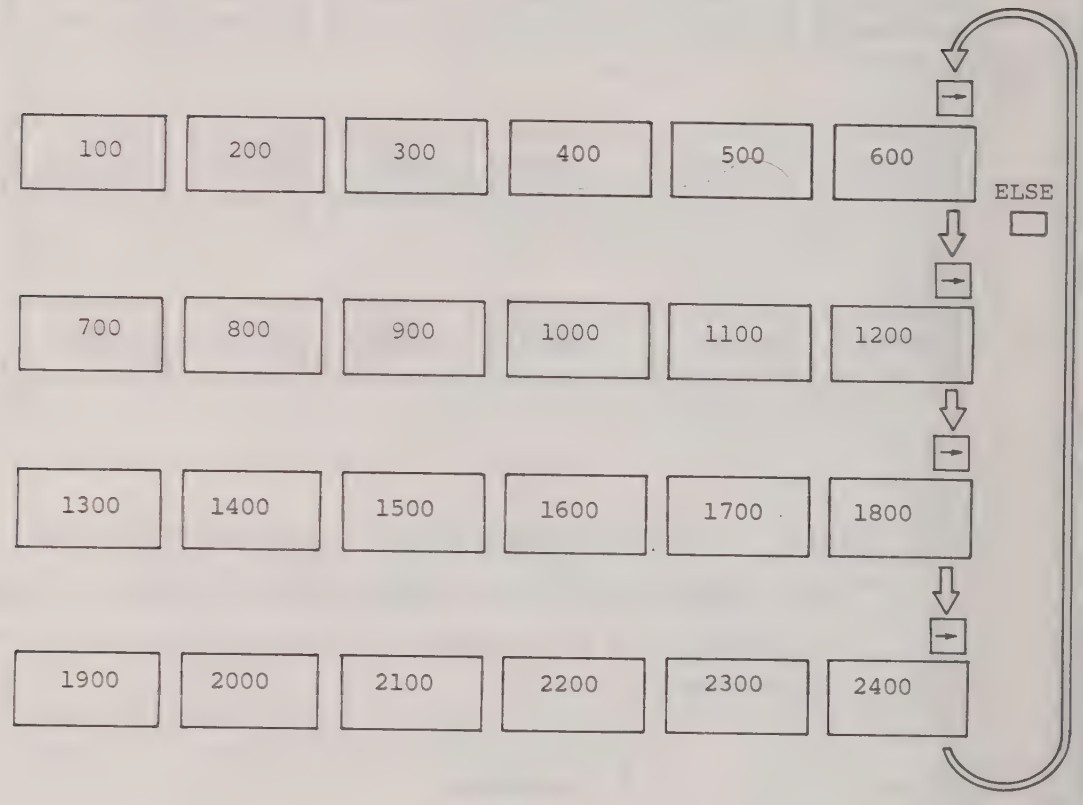
When AUTO, sync. loss detection condition is automatically set according to used unit or bit rate (paragraph 4.1 (2)).



Threshold Value Setting Screen

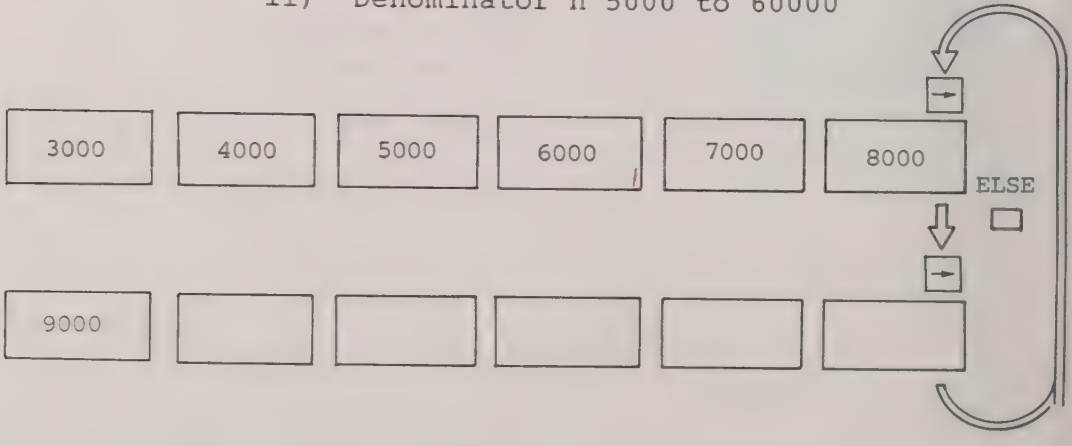
b) Numerator m setting when n other than AUTO selected

i) Denominator n 200 to 4000



The above menu value can be changed from 20 to 2560 (step 10) by pressing [MODIFY].

ii) Denominator n 5000 to 60000



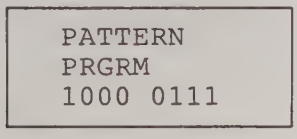
The above menu value can be changed from 2600 to 9900 (step 100) by pressing [MODIFY].

2) Patterns of A(0), Z(1), 1:1, 3:1, 1:3, 4:1, 1:4, 7:1, 1:7

No threshold setting

3) Pattern of PRGRM

To make the program bits all "1" or all "0", pressing [1] or [0] while holding down [ALL BIT].



PRGRM Pattern Setting Screen

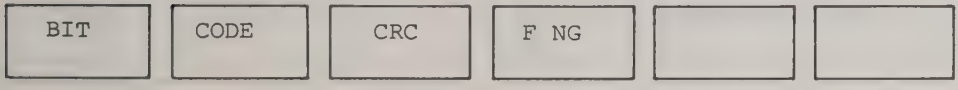
⑤ MEASURED ERROR

The type of error is changed according to the interface, timing, and frame setting.

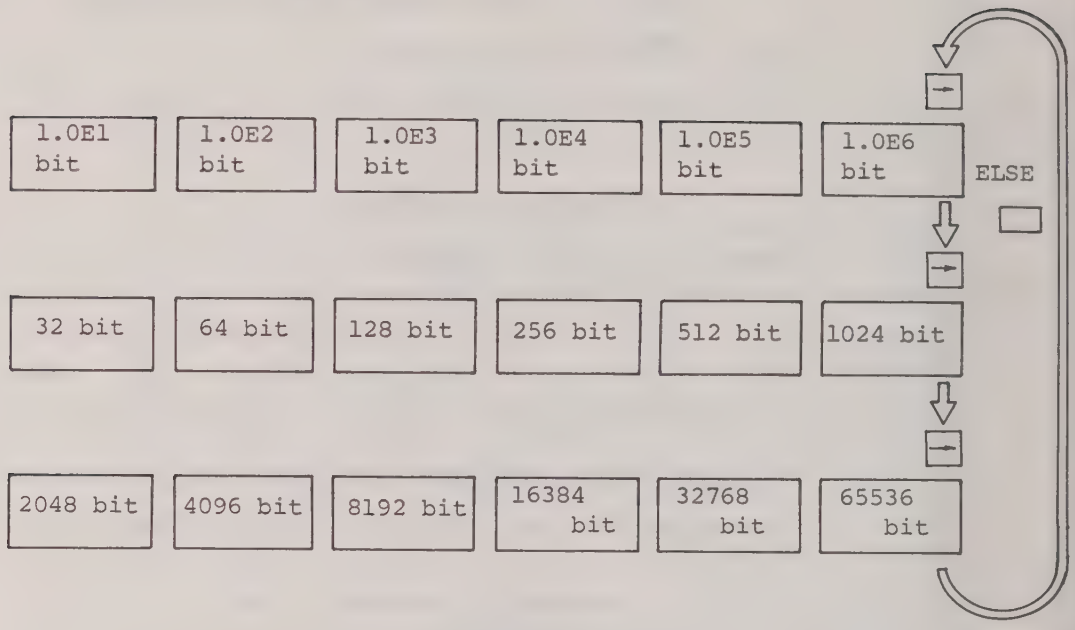
Since the error is only BIT for NON PARITY or other than (ST/SP) of MD0601B(V.35)/MD0601C(V.36)/ MD0601A(V.24/V.28), and for X.20 NON PARITY or other than (ST/SP), or X.21 of MD0601D(X.20/X.21); this item is skipped.

Example:

1.5 BPL, 24 MFP1



⑥ BLOCK LENGTH



⑦ CYCLIC ERROR

1.0E-1	1.0E-2	1.0E-3	1.0E-4	1.0E-5	1.0E-6

The above menu value can be changed from 2.5E-1 to 1.7E-7 (2.5×10^{-1} to 1.7×10^{-7}) by pressing [MODIFY].

Where, $N \times 10^{-n}$, N:1.0, 1.1, 1.3, 1.5, 1.7, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0

n: 1 to 7

⑧ MEASURE TIME

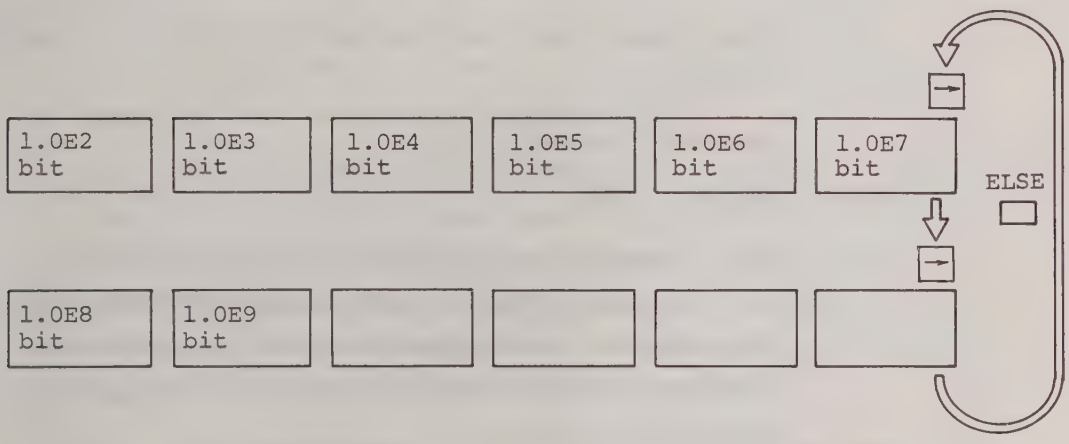
MANUAL	BIT	TIME	REPEAT TIME		

(i) MANUAL

Measurement continues until [STOP] is pressed.

(ii) BIT

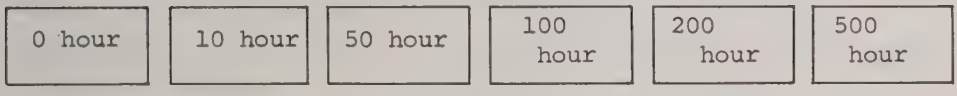
Measurement is performed until the set number of bits is reached. When the set number of bits is reached, measurement stops.



(iii) TIME

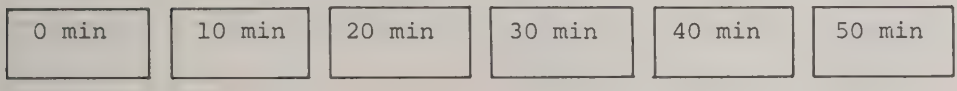
Measurement is performed for the set time.

1) hour (initial value: 0 hours)



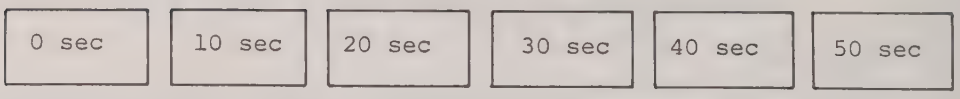
The above menu value can be changed from 0 to 999 by pressing [MODIFY].

2) minute (initial value: 0 minutes)



The above menu value can be changed from 0 to 59 by pressing [MODIFY].

3) second (initial value: 10 seconds)



The above menu value can be changed from 0 to 59 by pressing [MODIFY].

The range that can be set by TIME (1) to 3)) is:

0:00:10 to 999:59:59

(iv) REPEAT TIME

This repeats measurement for the set time. The measured results are output at each set time. Measurement is stopped manually. The last mneasured data becomes the total data from the measurement start.

(2) VOLT/FREQUENCY, COUNT/FREQUENCY

When [VOLT & FRQ] (or [COUNT & FRQ]) is selected on the INTERFACE screen menu (paragraph 3.4.3), the VOLT/FREQUENCY (or COUNT/FREQUENCY) screen appears.

The signal line that is measured is limited to the receive-side interface set at the INTERFACE screen.

Therefore, the monitor-line display is also limited at the receive side.

VOLT/FREQUENCY measurement is possible with the MD0601A/B/C/D interface. For other interfaces, VOLT measurement is not performed; only COUNT/FREQUENCY measurement is performed. At this time, the menu key becomes [COUNT & FRQ] and the voltage measurement items are not displayed.

The measurement procedure and set contents are the same, except that voltage is not measured.

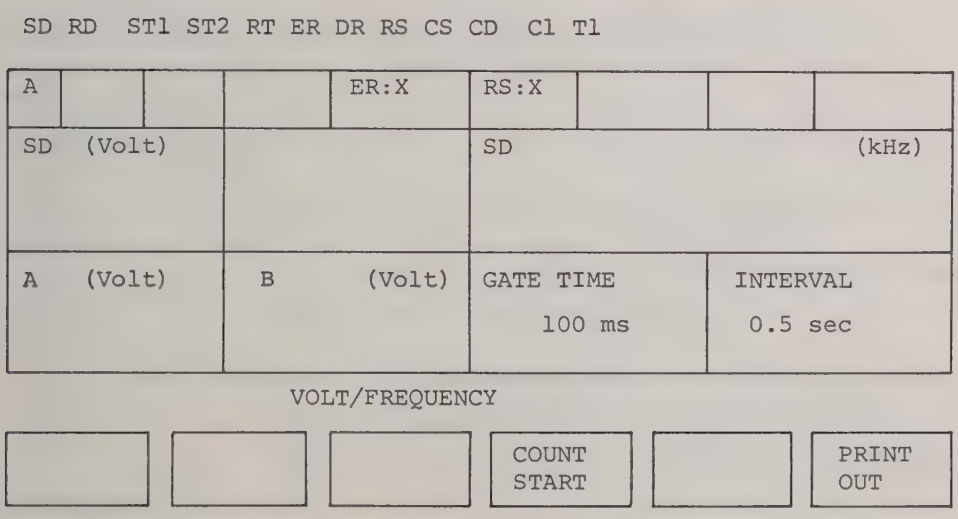


Fig. 3-15 VOLT/FREQUENCY Screen (V.35)

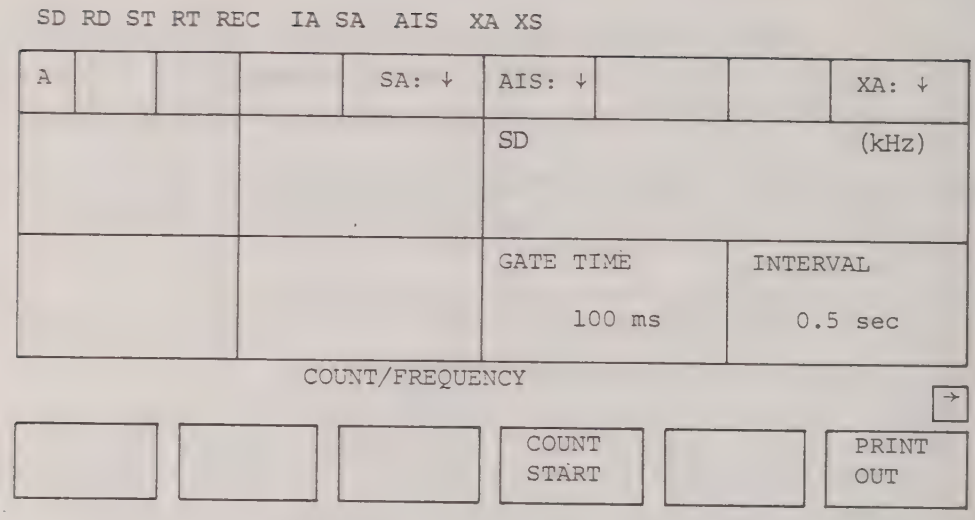


Fig. 3-16 COUNT/FREQUENCY Screen (1.5 BPL)

(a) Selecting function menu

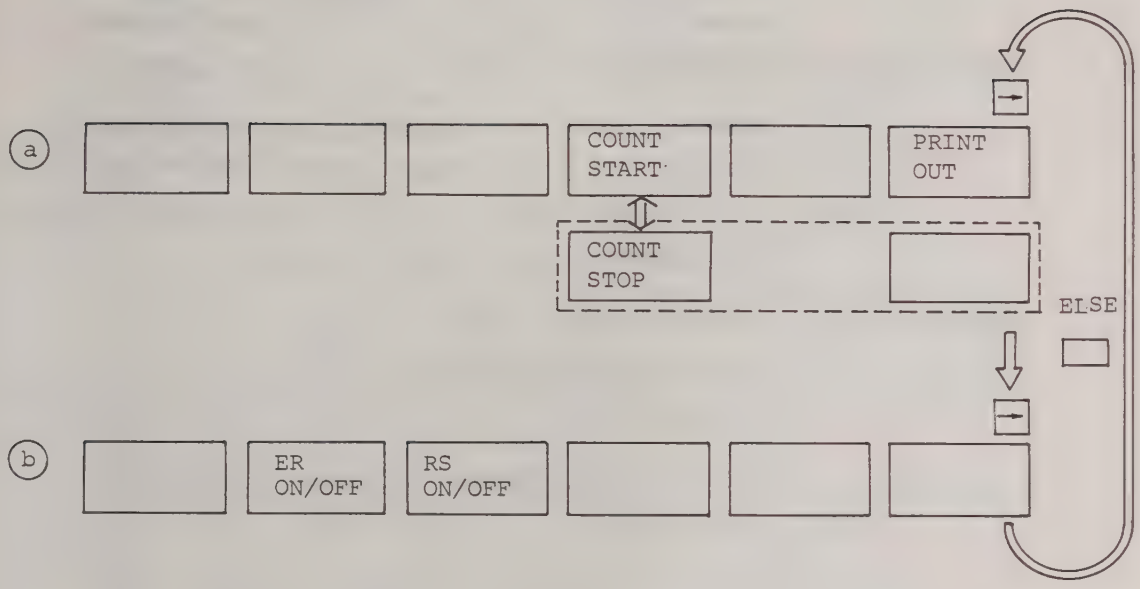


Fig. 3-17 VOLT (COUNT)/FREQUENCY-Screen Function Menu

Notes:

1. Menu (b) varies with the interface unit.

   For details, refer to the operation manual for each interface unit.

2. Menu (b) appears when the control line (ER or RS) is set to ON (↑) or OFF (↓).
   For OPEN (X), only menu (a) is displayed.

[COUNT START]: Measurement start key

[COUNT STOP]

When measurement is stopped, [COUNT START] is displayed. When the key is pressed, measurement starts. During measurement, the [COUNT START] changes to [COUNT STOP].

Measurement is stopped by pressing [COUNT STOP]. At this time, [COUNT STOP] changes to [COUNT START] and the instrument enters the measurement ready status.

[PRINT OUT]: Printer output key

The measurement results are output to the printer.

Refer to paragraph 3.5 for printing examples.

The printer cannot output during measurement. ([PRINT OUT] in the function menu is turned off).

[ER ON/OFF]/
[RS ON/OFF]: Control-line ON (↑)/OFF (↓) changeover key

When the control-line setting displayed on the control-line item on the screen is ON (↑) or OFF (↓), this menu is displayed.

The control line changes ON (↑)/OFF (↓) each time this key is pressed, and the set state is displayed at the control-line item (3) on the screen.

(b) Selecting item menu

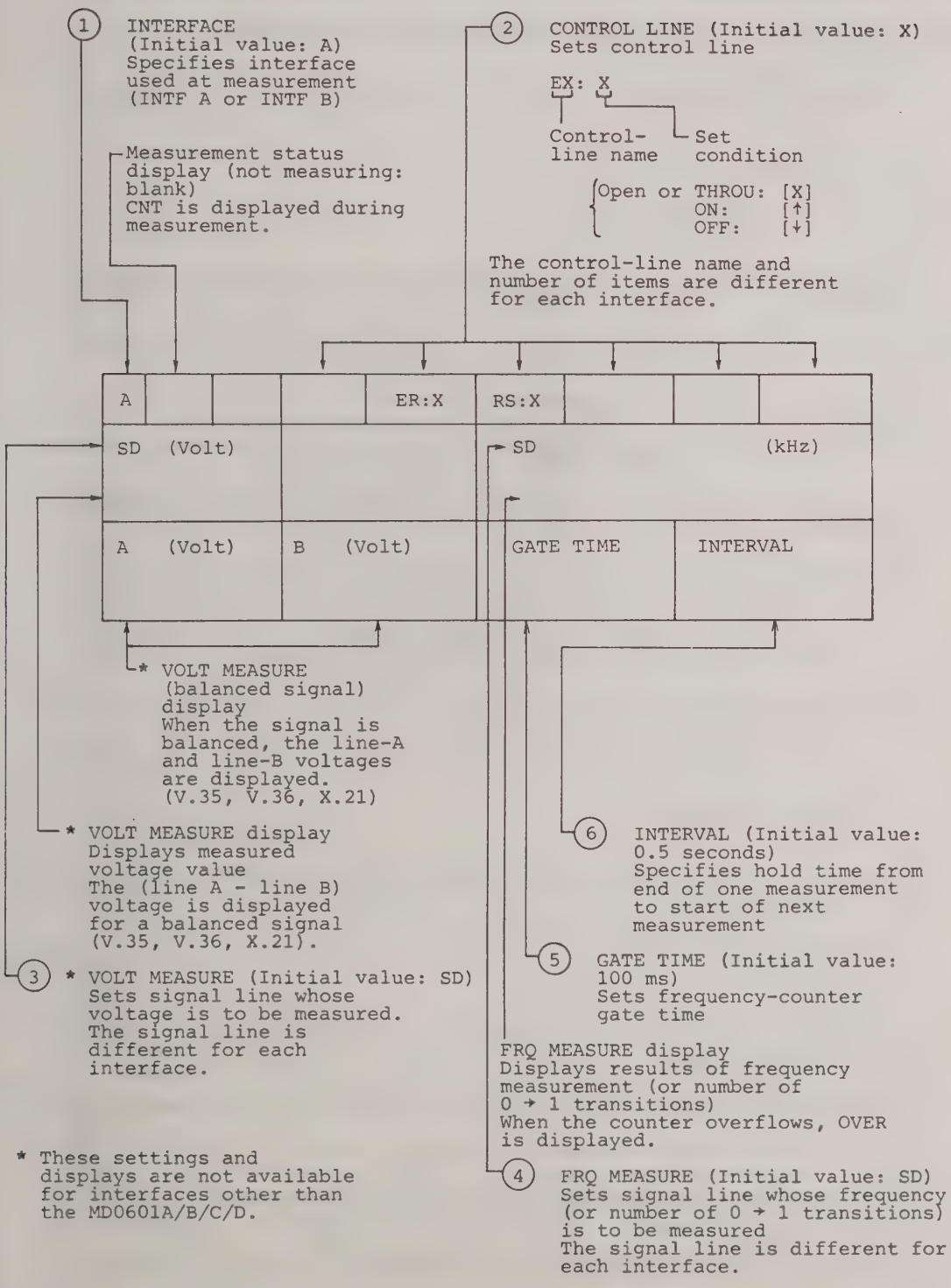


Fig. 3-18 VOLT (COUNT)/FREQUENCY-Screen Items

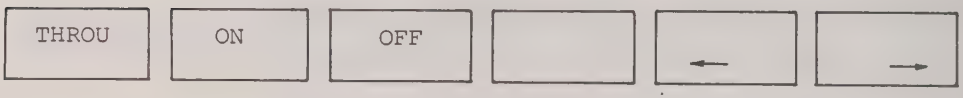
① INTERFACE

② CONTROL LINE

(i) MD0601A/B/C/D

(ii) Other interface units

1) SEND THROU

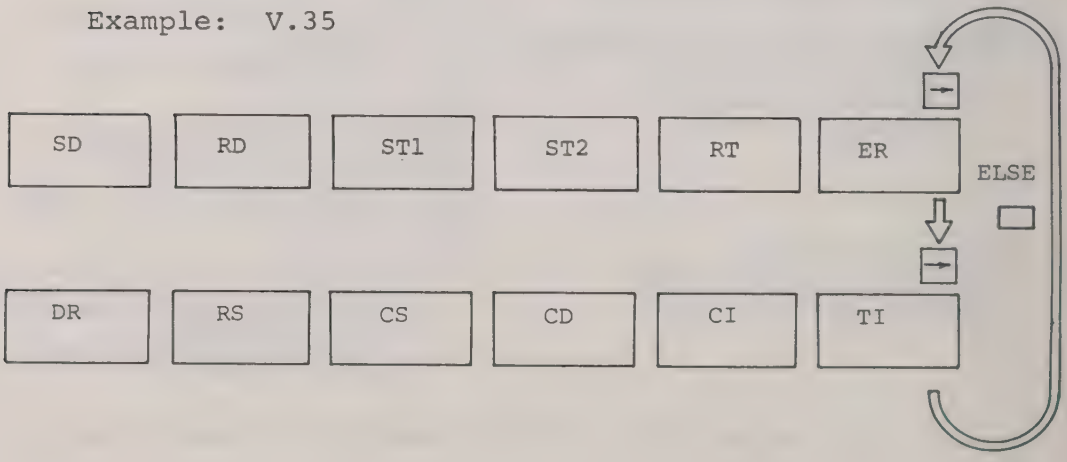


2) Other than SEND THROU

③ VOLT MEASURE

The signal line that is set varies with the type of interface.

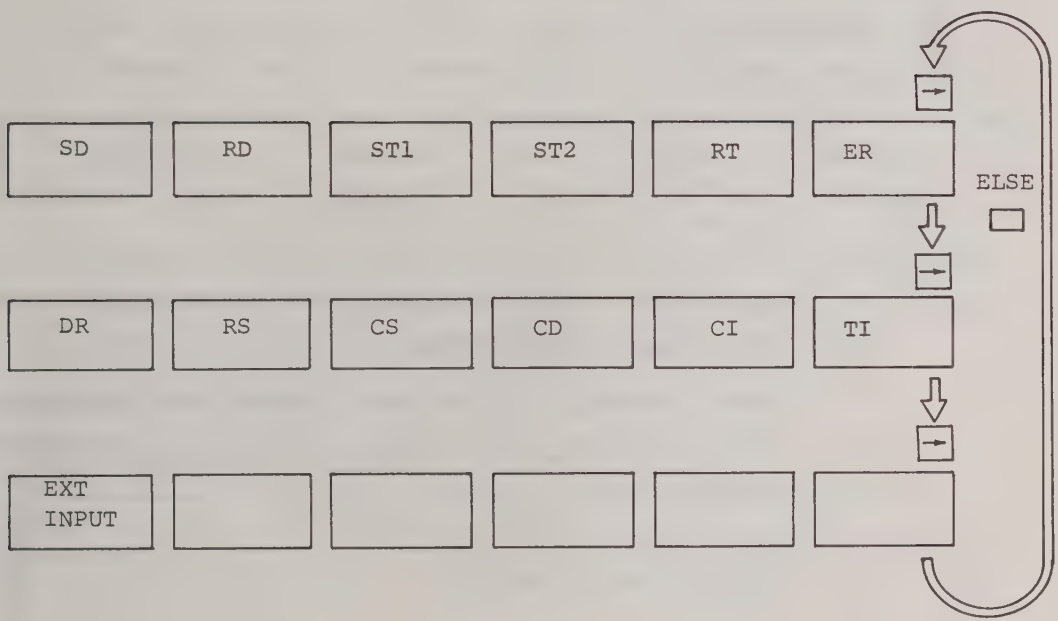
Example: V.35



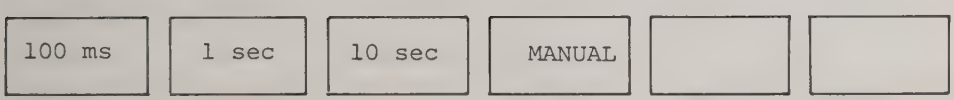
④ FRQ MEASURE

The signal line that is set varies with the type of interface.

Example: V.35



⑤ GATE TIME



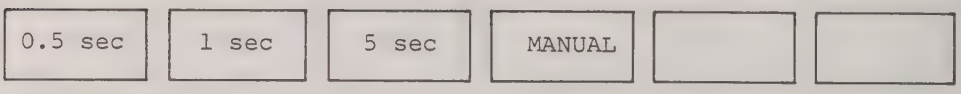
(i) [100 ms], [1 sec], [10 sec]: Sets frequency-counter gate time

Gate time	Freq. display unit
100 ms	kHz
1 sec	Hz
10 sec	Hz

(ii) [MANUAL]: Set when measuring number of 0 → 1 transitions

In this case, counting is performed from when [COUNT START] is pressed to when [COUNT STOP] is pressed.

⑥ INTERVAL



Specifies hold time from end of one measurement to start of next measurement

When [MANUAL] is pressed; after the measurement end, the measured results are held until [COUNT START] is pressed again.

(3) DELAY TIME

When [DELAY] (or [DELAY TIME]) is selected on the INTERFACE screen menu (paragraph 3.4.3), the DELAY TIME screen appears.

LINE INTERVAL (time between conversion points of one signal line or two different signal lines) or TRANSMIT DELAY (transmission delay time) measurement is performed in accordance with the DELAY TIME screen settings.

For the MD0601A/B/C/D interface units, DELAY is displayed as a menu key. For other interface units, DELAY TIME is displayed. The measurement procedure and set contents are all the same.

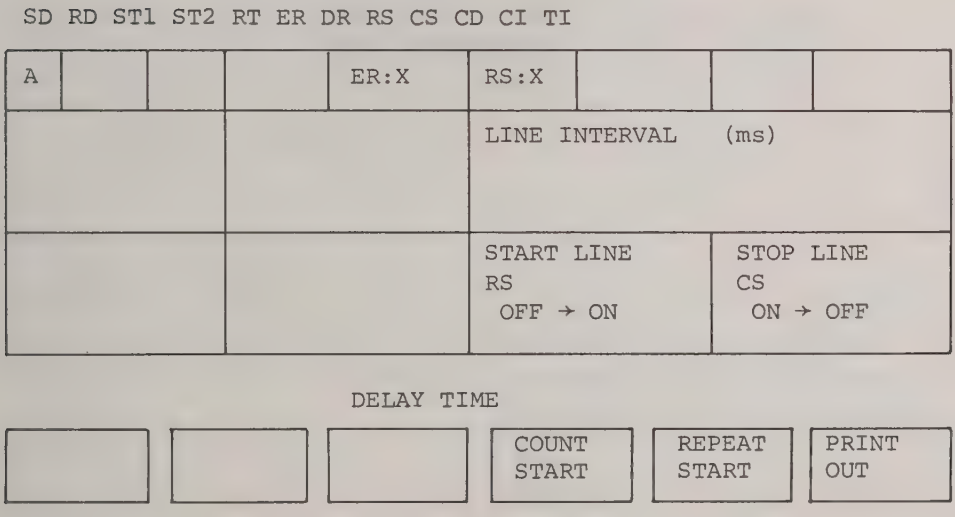


Fig. 3-19 DELAY TIME Screen (LINE INTERVAL)

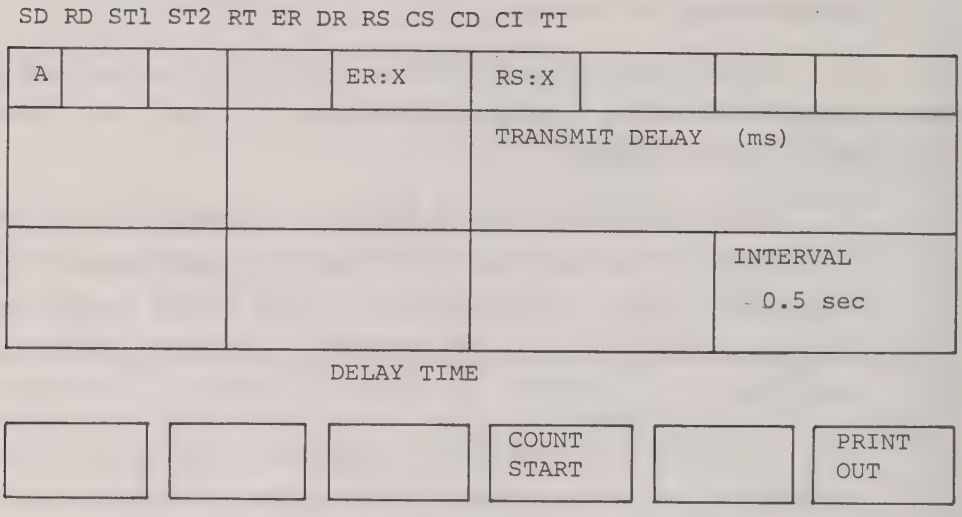


Fig. 3-20 DELAY TIME Screen (TRANSMIT DELAY)

(a) Selecting function menu

LINE INTERVAL:

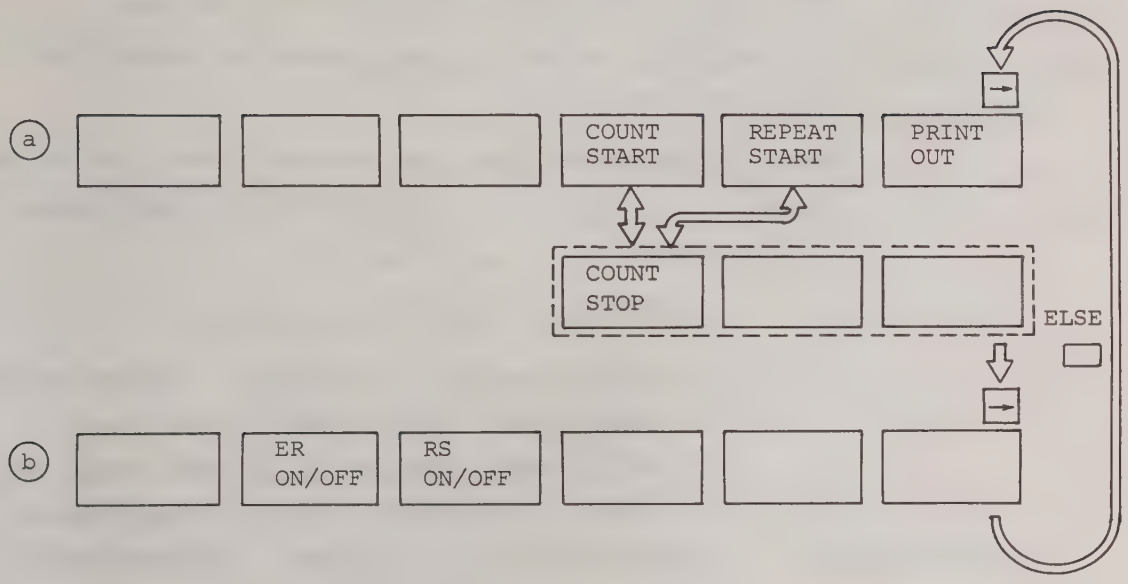


Fig. 3-21 DELAY TIME-Screen Function Menu (LINE INTERVAL)

TRANSMIT DELAY:

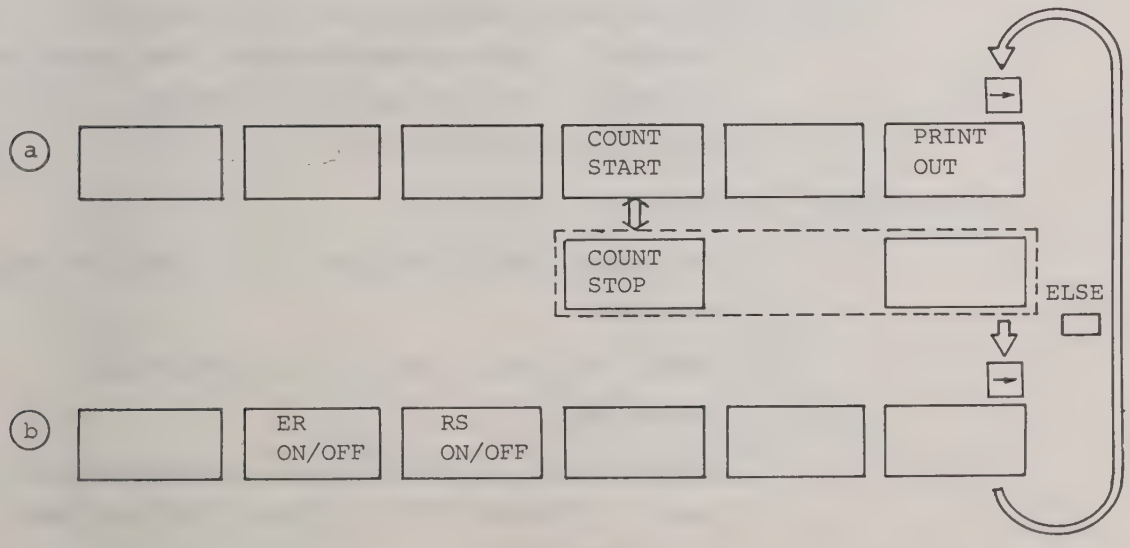


Fig. 3-22 DELAY TIME-Screen Function Menu (TRANSMIT DELAY)

Notes:

1. Menu (b) varies with the interface unit.

   For details, refer to the operation manual of each interface unit.

2. Menu (b) appears when the control line (ER or RS) is ON (↑) or OFF (↓). For OPEN (X), only menu (a) is displayed.

[COUNT START]: Measurement start and stop key

[COUNT STOP]

When measurement is stopped, [COUNT START] is displayed. Measurement starts and [COUNT START] changes to [COUNT STOP] when this key is pressed. During measurement, [COUNT STOP] is displayed. Measurement is ended by pressing [COUNT STOP]. At this time, [COUNT STOP] changes to [COUNT START].

[REPEAT START]: Repetitive measurement start key

Measurement starts when this key is pressed. During measurement, the menu is blanked. Measurement is ended by pressing [COUNT STOP].

[PRINT OUT]: Printer output key

The measurement results are output to the printer.

Refer to paragraph 3.5 for printing examples.

The printer cannot output during measurement. ([PRINT OUT] in the function menu is turned off.)

[ER ON/OFF]/
[RS ON/OFF]: Control-line ON (↑)/OFF (↓) changeover key

When the control-line setting displayed on the control-line item on the screen is ON (↑) or OFF (↓), this menu is displayed.

The control line changes on (↑)/OFF (↓) each time this key is pressed, and the set state is displayed at the control-line item on the screen.

(b) Selecting item menu

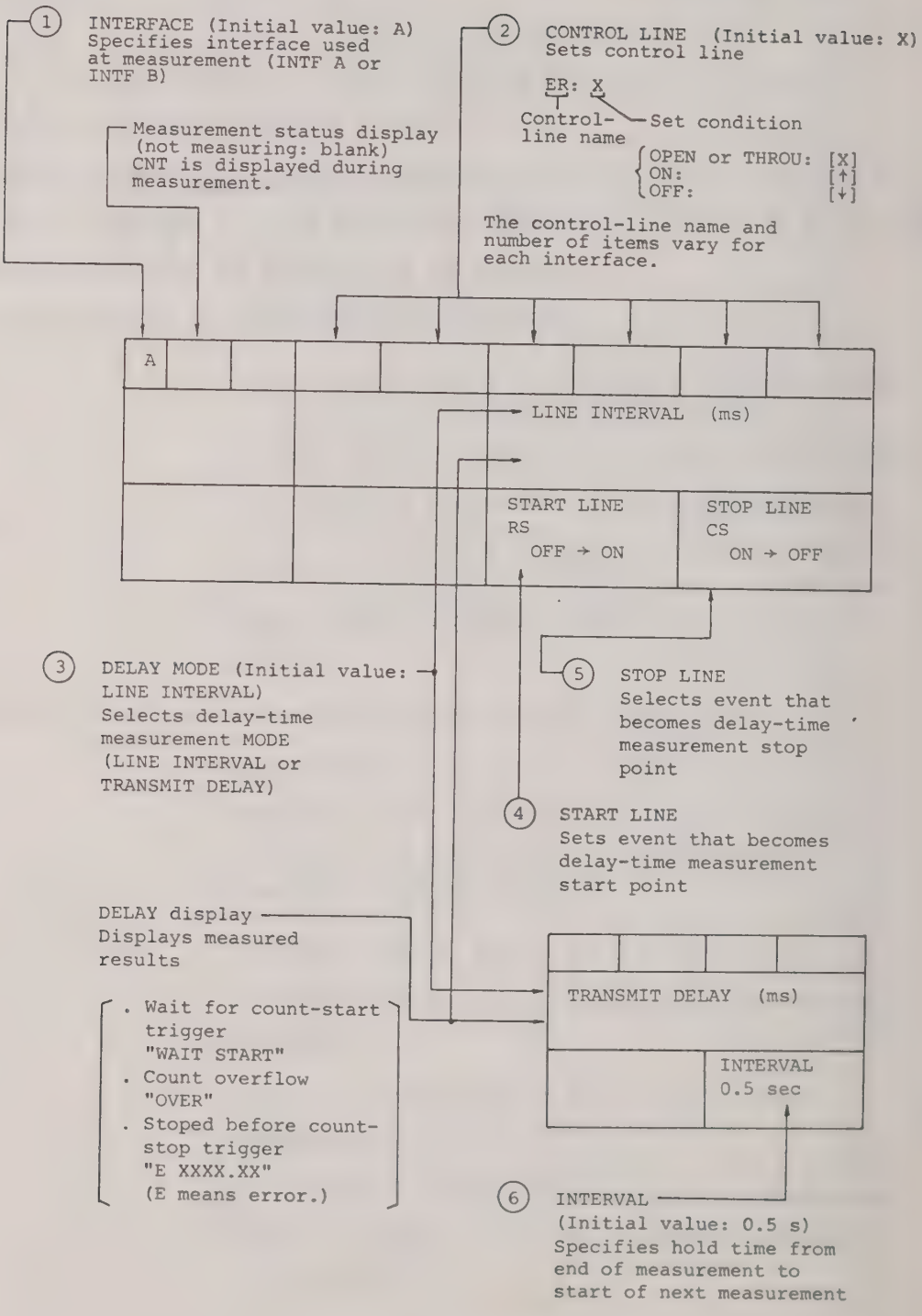


Fig. 3-23 DELAY TIME-Screen Items

① INTERFACE

② CONTROL LINE

(i) MD0601A/B/C/D

(ii) Other interface units

1) SEND THROU

2) Other than SEND THROU

③ DELAY MODE

[LINE INTRVL]: Measures time between conversion points of signals

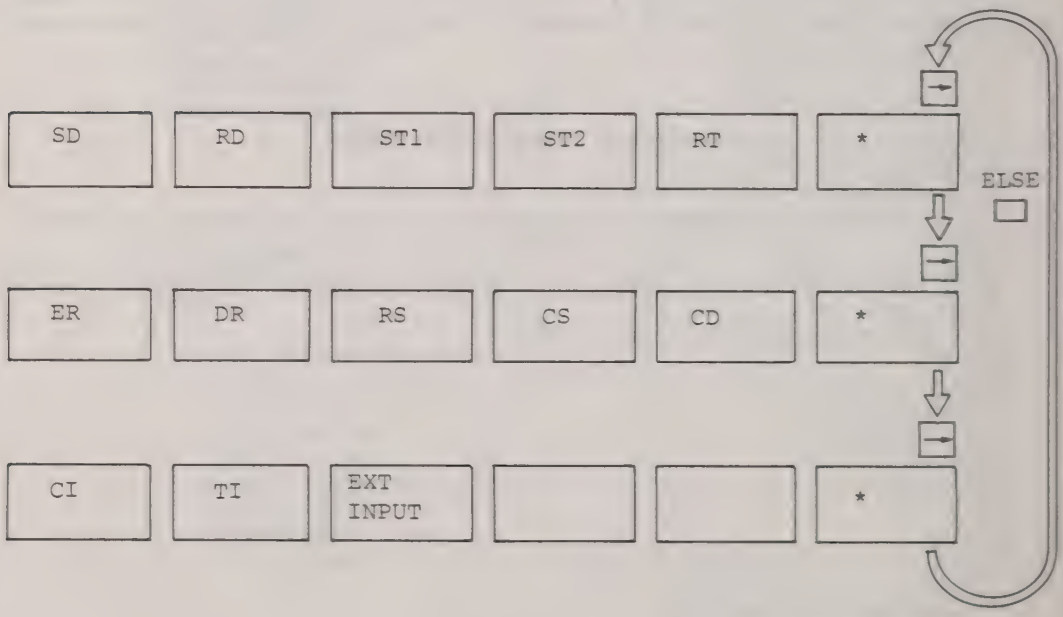
[TRANSMIT DELAY]: Measures time from sending data to its return

④ START LINE

Set when DELAY MODE ③ is LINE INTERVAL.

The signal-line name that is set varies with the type of interface.

Example: V.35



* Depending on the currently-set signal line; [1/0], [ON/OFF], or [HIGH/LOW] is displayed.

(i) [1/0]

Displayed when SD or RD (T or R for X.20/X.21) selected as signal line

This soft key is a toggle switch that performs trigger-on/trigger-off switching. (0 → 1), (1 → 0) switching is performed each time it is pressed.

(ii) [HIGH/LOW]

Displayed when EXT INPUT selected as signal line

This soft key is a toggle switch that performs trigger-on/trigger-off switching.

(LOW → HIGH)/(HIGH → LOW) switching is performed each time it is pressed.

(iii) [ON/OFF]

Displayed when other than above in paragraphs (i) and (ii) selected as signal line

This soft key is a toggle switch that performs trigger-on/trigger-off switching. (OFF → ON)/(ON → OFF) switching is performed each time it is pressed.

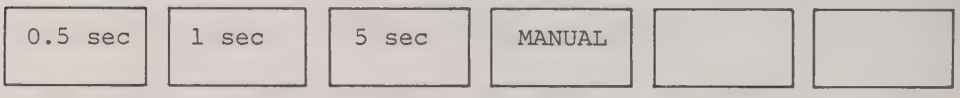
⑤ STOP LINE

Set when DELAY MODE ③ is LINE INTERVAL

The display and setting contents are the same as those of START LINE ④.

⑥ INTERVAL

Set when DELAY MODE ③ is TRANSMIT DELAY



At MANUAL, the measured results are held from the measurement end until [COUNT START] is pressed again.

(4) WORD TRACE

When [WORD TRACE] is selected on the INTERFACE screen menu (paragraph 3.4.3), the WORD GENERATE/ PATTERN TRACE screen appears.

The results of the pattern trace performed with the parameters set at this screen can be viewed at the TRACE DISPLAY screen (paragraph 3.4.4 (5)).

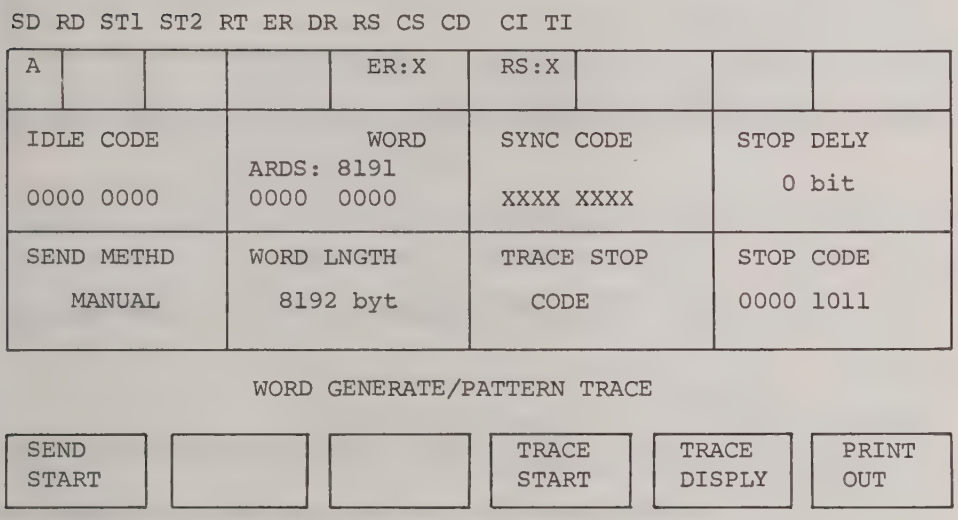


Fig. 3-24 WORD TRACE Screen

(a) Selecting function menu

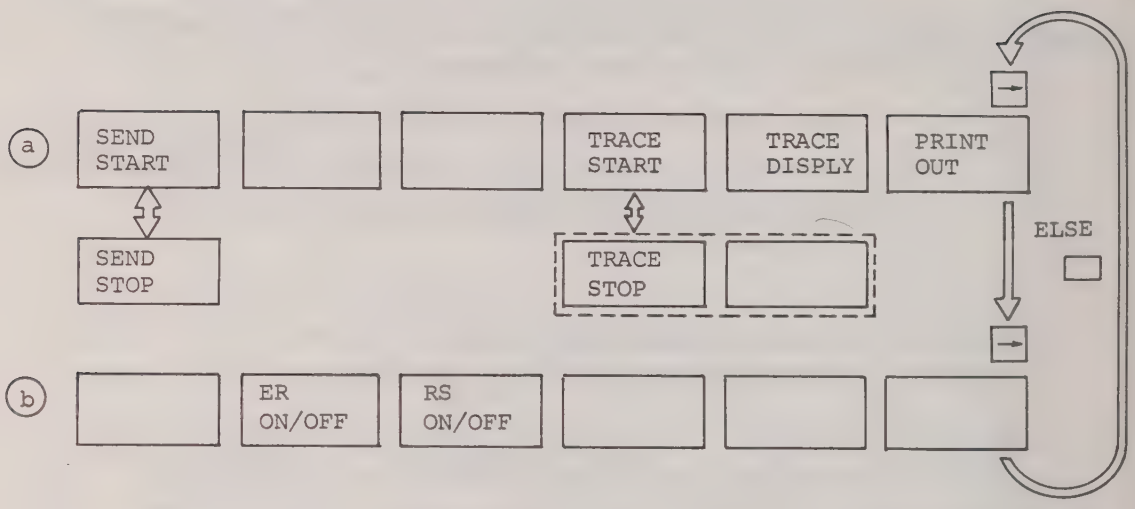


Fig. 3-25 WORD TRACE-Screen Function Menu

Notes:

1. Menu (b) varies with the interface unit.
   For details, refer to the operation manual of each interface unit.
2. Menu (b) appears when the control line (ER or RS) is set to ON (↑) or OFF (↓).
   For OPEN (X), only menu (a) is displayed.

[SEND START]: Pattern-send start and stop key

[SEND STOP]

During sending stop, [SEND START] is displayed. Sending is started by pressing [SEND START] and the [SEND START] changes to [SEND STOP].

Sending is ended by pressing the [SEND STOP] and the [SEND STOP] changes to [SEND START].

[TRACE START]: Pattern-trace start and stop key

[TRACE STOP]

During tracing stop, [TRACE START] is displayed. Tracing is started by pressing [TRACE START] and [TRACE START] changes to [TRACE STOP].

Tracing is ended by pressing [TRACE STOP] and [TRACE STOP] changes to [TRACE START].

[TRACE DISPLY]: Trace-display screen changeover key

The screen is switched to the trace-display screen by pressing this key. However, during tracing, the menu is blanked and the screen cannot be switched to the trace-display screen.

[PRINT OUT]: Printer output key

This key outputs the set contents to the printer.

[ER ON/OFF]/
[RS ON/OFF]: Control-line ON (↑)/OFF (↓) changeover key

When the control-line setting displayed on the control-line item on the screen is ON (↑) or OFF (↓), this menu is displayed.

The control line changes ON (↑)/OFF (↓) each time this key is pressed, and the set state is displayed at the control-line item on the screen.

(b) Selecting item menu

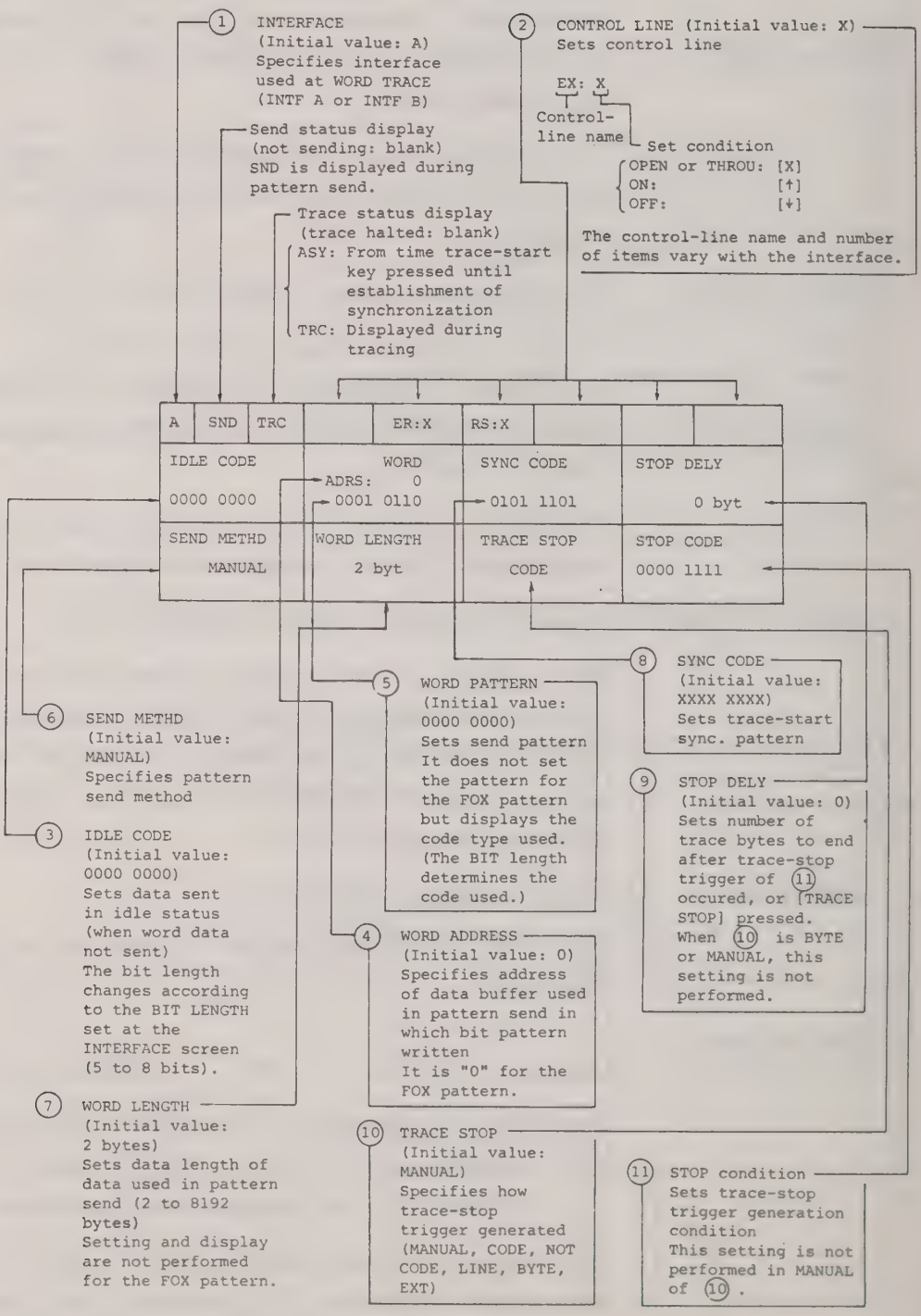

1 INTERFACE
(Initial value: A)
Specifies interface used at WORD TRACE
(INTF A or INTF B)
Send status display
(not sending: blank)
SND is displayed during pattern send.
Trace status display
(trace halted: blank)
ASY: From time trace-start key pressed until establishment of synchronization
TRC: Displayed during tracing
2 CONTROL LINE (Initial value: X)
Sets control line
EX: X
Control-line name
Set condition
OPEN or THROU: [X]
ON: [↑]
OFF: [↓]
The control-line name and number of items vary with the interface.
A
SND
TRC
ER:X
RS:X
IDLE CODE
0000 0000
WORD ADRS: 0
0001 0110
SYNC CODE
0101 1101
STOP DELY
0 byt
SEND METHD
MANUAL
WORD LENGTH
2 byt
TRACE STOP CODE
STOP CODE
0000 1111
6 SEND METHD
(Initial value: MANUAL)
Specifies pattern send method
3 IDLE CODE
(Initial value: 0000 0000)
Sets data sent in idle status (when word data not sent)
The bit length changes according to the BIT LENGTH set at the INTERFACE screen (5 to 8 bits).
7 WORD LENGTH
(Initial value: 2 bytes)
Sets data length of data used in pattern send (2 to 8192 bytes)
Setting and display are not performed for the FOX pattern.
5 WORD PATTERN
(Initial value: 0000 0000)
Sets send pattern
It does not set the pattern for the FOX pattern but displays the code type used.
(The BIT length determines the code used.)
4 WORD ADDRESS
(Initial value: 0)
Specifies address of data buffer used in pattern send in which bit pattern written
It is "0" for the FOX pattern.
8 SYNC CODE
(Initial value: XXXX XXXX)
Sets trace-start sync. pattern
9 STOP DELY
(Initial value: 0)
Sets number of trace bytes to end after trace-stop trigger of 11 occured, or [TRACE STOP] pressed.
When 10 is BYTE or MANUAL, this setting is not performed.
10 TRACE STOP
(Initial value: MANUAL)
Specifies how trace-stop trigger generated
(MANUAL, CODE, NOT CODE, LINE, BYTE, EXT)
11 STOP condition
Sets trace-stop trigger generation condition
This setting is not performed in MANUAL of 10.

Fig. 3-26 WORD TRACE Screen Items

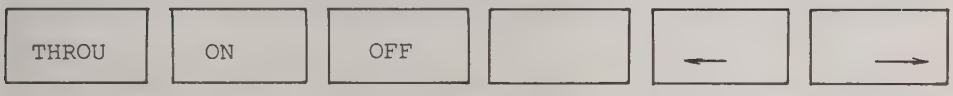
① INTERFACE

② CONTROL LINE

(i) MD0601A/B/C/D

(ii) Other interface units

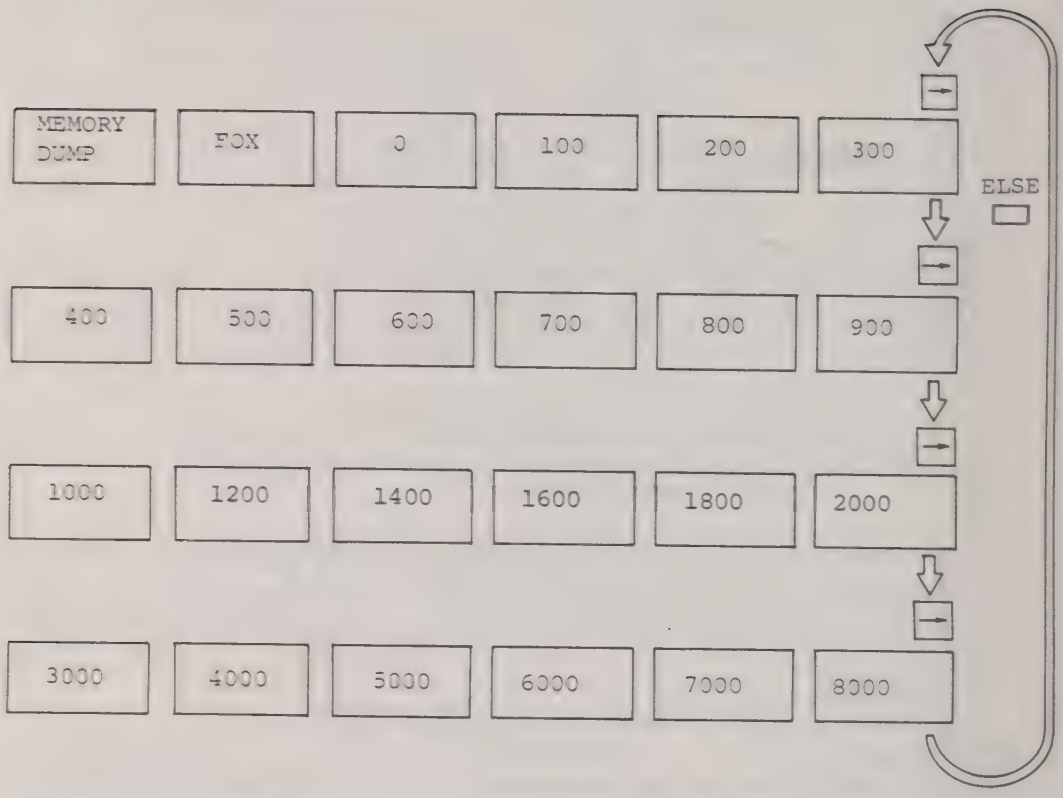
1) SEND THROU



2) Other than SEND THROU

③ IDLE CODE

④ WORD ADDRESS



[MEMORY DUMP]:

[MEMORY DUMP] is displayed when MD0610D WORD MEM (measurement extension unit) is set. The bit pattern written in the ROM in the MD0610D can be accessed by using [MEMORY DUMP].

When [MEMORY DUMP] is turned on, ADRS: DUMP is displayed and dumping from the MD0610D ROM starts. At the end of dumping, ADRS:8191 is displayed.

[FOX]:

The FOX pattern "ThE QuicK BrowN FoX JumpS OveR ThE LazY DoG 123 456 7890 +-*:=$%()" is set. When FOX is selected, ADRS:0 is displayed and FOX:XXXX is displayed at the WORD PATTERN ⑤ position.

The above address can be changed from 0 to 8191 by pressing [MODIFY].

⑤ WORD PATTERN

Sets pattern in address specified by ④ WORD ADDRESS

When FOX is specified at WORD ADDRESS ④, setting is not performed. (The cursor skips this item and goes to the next item.)

ENTER	0	1	ALL BIT	→	RECALL

[ENTER]: The displayed data is confirmed and WORD ADDRESS ④ is incremented by one.

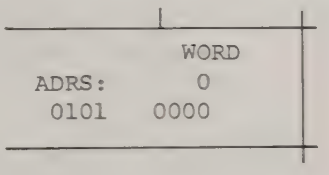
[ALL BIT]: "All 1" or "All 0" can be set by pressing [1] or [0] while holding down [ALL BIT].

[RECALL]: Replaces current data with data entered immediately before

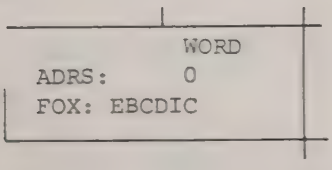
When FOX is specified at WORD ADDRESS ④, the display becomes as follows.

When the FOX pattern is specified, the type of code used is displayed at the pattern display section.

(Other than FOX)



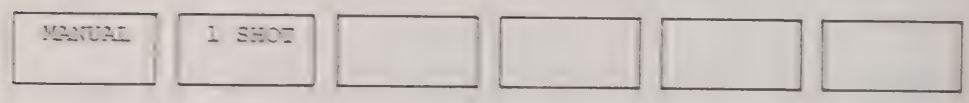
(FOX)



The code type varies according to the BIT LENGTH set at the INTERFACE screen (paragraph 3.4.3).

Bit length	8	7	6	5
Code type	EBCDIC	ASCII	EBCD	Baudot

⑥ SEND METHD



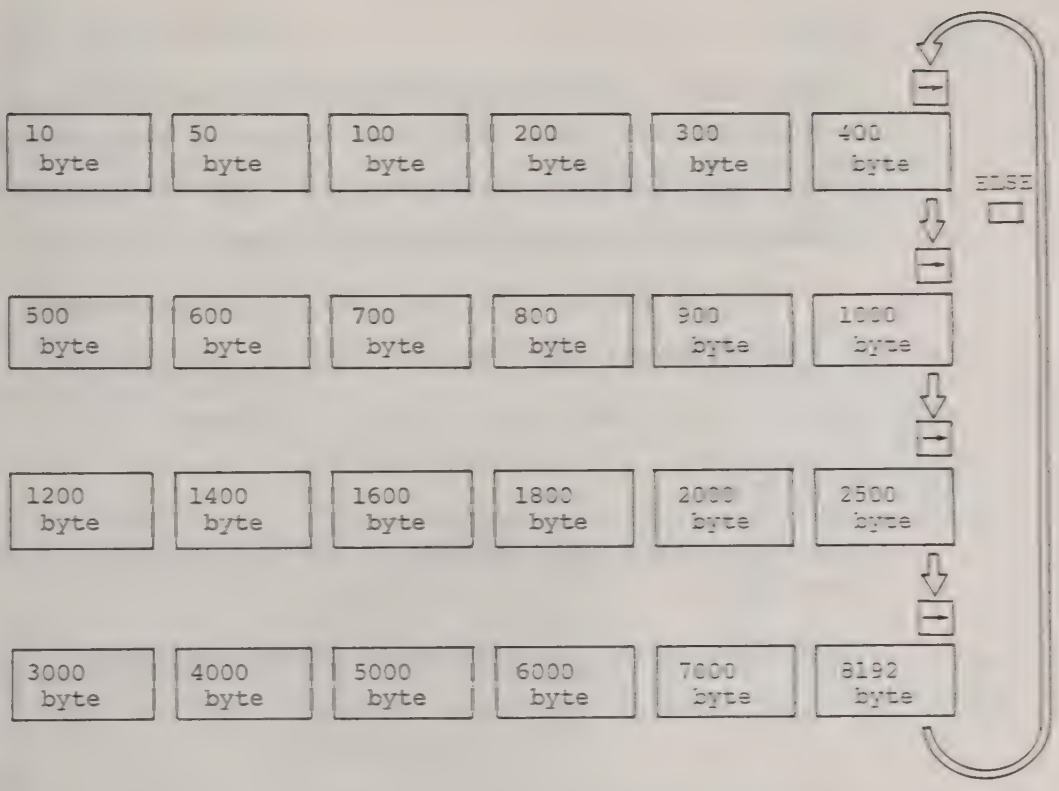
[MANUAL]: Sends set pattern repeatedly until [SEND STOP] pressed

[1 SHOT]: Sends set pattern once and end pattern send

⑦ WORD LENGTH

Sets data length when other than FOX specified at WORD ADDRESS ④

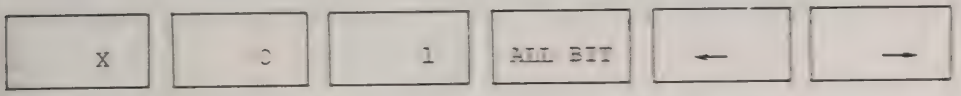
When FOX is specified, this is not displayed.



The above data length can be changed from 2 to 8192 bytes by pressing [MODIFY].

⑧ SYNC CODE

Sets trace-start condition



[X]: Assumes that sync. pattern agrees unconditionally

When [X] is turned on, all the bits become X ("don't care").

[ALL BIT]: "All 1" or "All 0" can be set by pressing [1] or [0] while holding down [ALL BIT].

Note:

The trace-start trigger condition can be set by SYNC CODE, bit if this SYNC CODE does not repeat for four or more consecutive bytes, the trace not triggered.

Example: When SYNC CODE 7E is set

Receive pattern 7E, AA, 3A, D6 (not traced)

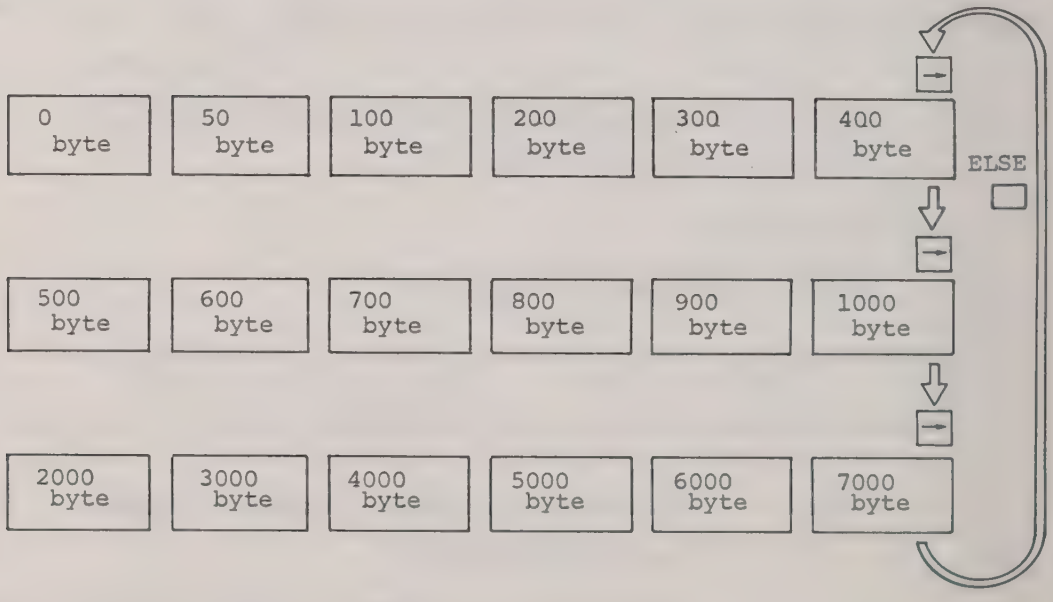
Receive pattern 7E, 7E, 7E, 7E, AA, 3A, D6

(Traced)

⑨ STOP DELAY

Set when other than MANUAL or BYTE specified at TRACE STOP ⑩ .

This item is not displayed at MANUAL or BYTE.



The above data length can be changed from 0 to 8000 bytes by pressing [MODIFY].

⑩ TRACE STOP

Sets trace-stop condition type

MANUAL	CODE	NOT CODE	LINE	BYTE	EXT

[MANUAL]: Trace ends when [TRACE STOP] pressed

In this mode, there are no STOP DELAY ⑨ STOP condition ⑪ settings.

[CODE]: Stop-trigger applied when receive-data bit matches STOP CODE ⑪ (STOP condition)

[NOT CODE]: Stop-trigger applied when receive-data bit does not match STOP CODE ⑪ (STOP condition)

[LINE]: Stop-trigger applied by ON/OFF of signal line specified by LINE SLCT ⑪

[BYTE]: Stop-trigger applied when number of bytes specified by TRACE BYTE ⑪ traced

In this mode, there is no STOP DELAY ⑨ setting.

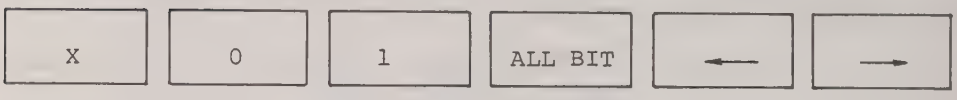
[EXT]: Stop-trigger applied by HIGH/LOW of EXT INPUT ⑪

⑪ STOP condition

Sets the stop condition for specified trace-stop condition types other than MANUAL at TRACE STOP ⑩.

(i) STOP CODE

Set when CODE or NOT CODE specified at TRACE STOP ⑩.



[X]: Don't care

Used at bits which can be ignored when STOP CODE bit-pattern set

Example: XX11 0011

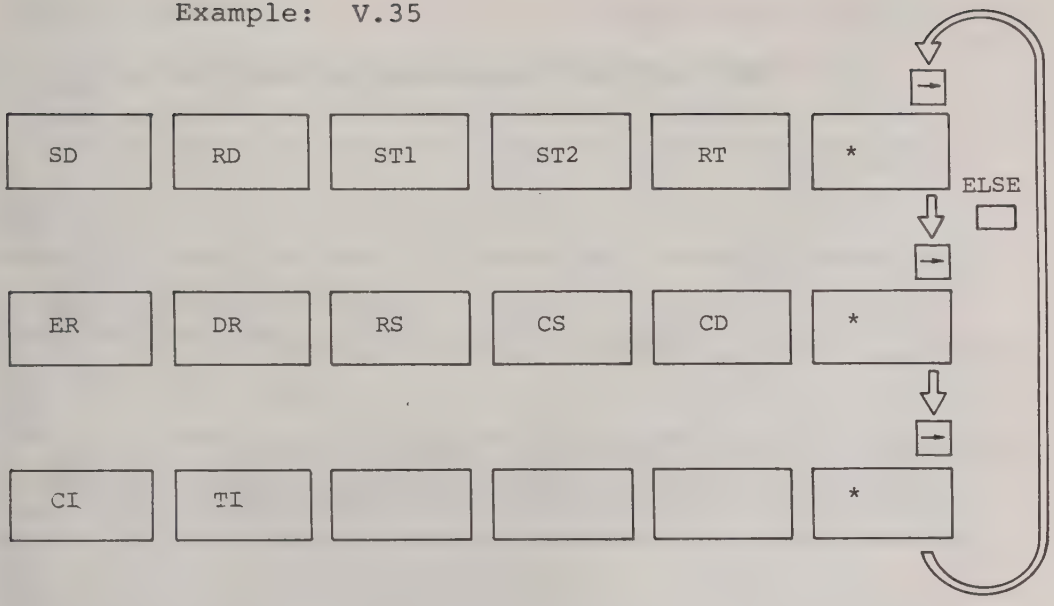
[ALL BIT]: "All 1" or "All 0" can be set by pressing [1] or [0] while holding down [ALL BIT].

(ii) LINE SELECT

Set when LINE specified at TRACE STOP ⑩

One of the signal lines displayed on the monitor can be set.

Example: V.35



* Depending on the currently-set signal line, 1/0 or ON/OFF is displayed.

[1/0]:

Displayed when SD or RD (T or R for X.20/X.21) selected as signal line

This soft key is a toggle switch which performs trigger-on/trigger-off switching. (0 → 1)/ (1 → 0) switching is performed each time it is pressed.

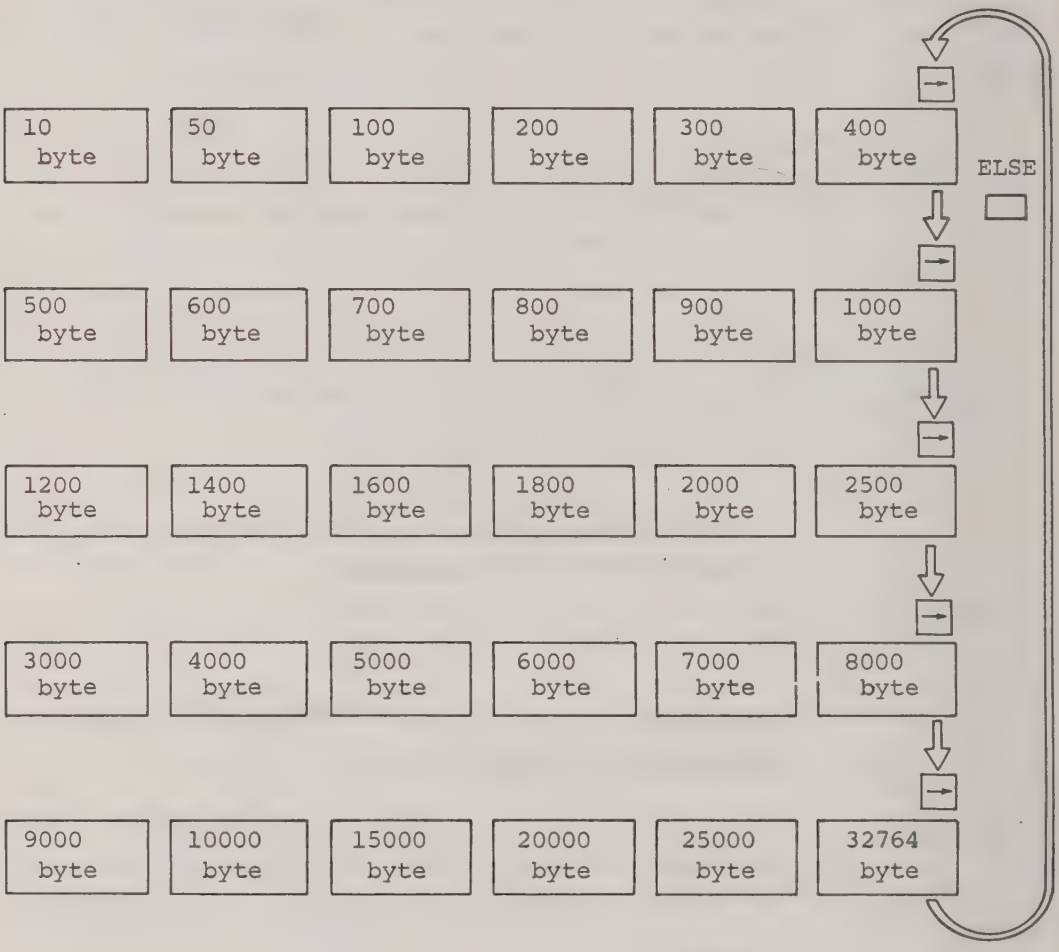
[ON/OFF]:

Displayed when other than SD or RD (T or R for X.20/X.21) selected as signal line

This soft key is a toggle switch which performs trigger-on/trigger-off switching. (OFF → ON)/ (ON → OFF) switching is performed each time it is pressed.

(iii) TRACE BYTE

Set when BYTE specified at TRACE STOP (10)



The above menu value can be changed from 0 to 32764 bytes by pressing [MODIFY].

However, when it is set to TRACE BYTE 0 or 1, tracing does not stop.

(iv) EXT INPUT

Set when EXT specified at TRACE STOP (10)

[HIHG/LOW]:

Displayed when EXT INPUT selected as signal line

This soft key is toggle switch that performs trigger-on/trigger-off switching. (OFF → ON)/(ON → OFF) switching is performed each time it is pressed.

(5) TRACE DISPLAY

When [TRACE DISPLAY] is selected on the INTERFACE screen menu (paragrpah 3.4.3), the PATTERN TRACE screen is displayed.

Immediately after this screen is switched to appear, the line containing the trigger data is seen at the page end. The remainder of the line containing the trigger data (end of trace data) and the subsequent lines are padded with **, and addresses 32768 and 32769 are padded with -- because they are out of memory area.

The data that became the trigger is reverse-displayd.

ADRS	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	STOP
32 720	7E	7E	7E	40	41	42	43	44	45	46	NOV
32 730	00	01	02	03	04	05	06	07	08	09	1986
32 740	0A	0B	0C	0D	0E	0F	10	11	12	12	11
32 750	14	15	16	17	18	19	1A	1B	1C	1D	10:09
32 760	1E	1F	7E	7E	**	**	**	**	--	--	59

PATTERN TRACE (HEX)

WORD TRACE	DISP CODE	SCROL ↓	SCROL ↑	SCROL NEXT	PRINT OUT

Fig. 3-27 PATTERN TRACE Screen

(a) Selecting function menory

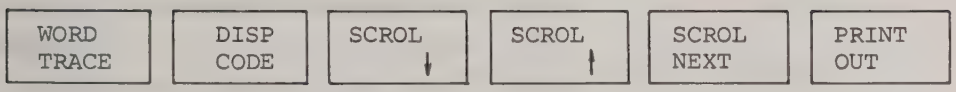


Fig. 3-28 PATTERN TRACE-Screen Function Menu

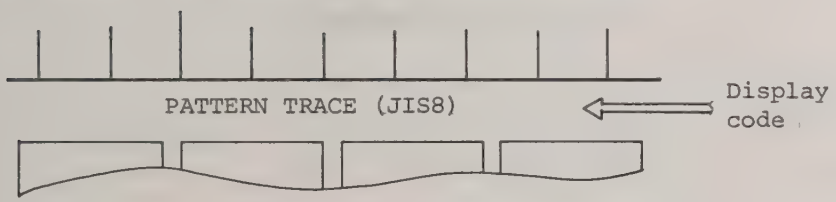
[WORD TRACE]: WORK TRACE screen changeover key

The screen is witched to the WORD TRACE screen by pressing this key.

[DISP CODE]: TRACE data display-code changeover key

This key selects the display code from HEX, ASCII, EBCDIC, EBCDIK, and JIS8.

The selected display code is displayed on the screen.



[SCROL ↓]: Scroll (↓) key

The display address is scrolled by -10 each time this key is pressed. When this key is held down for 1 second or longer, the displayed address is scrolled continuously.

The address after address 0 is wrapped-around to 32760.

[SCROL ↑]: Scroll (↑) key

The displayed address is scrolled by +10 each time this key is pressed. When this key is held down for 1 second or longer, the displayed address is scrolled continuously.

The address after address 32760 is wrapped-around to 0.

[SCROLL NEXT]: Scroll (next screen display) key

The displayed address is scrolled by +50 each time this key is pressed. When the displayed address reaches 32770, it becomes 0.

[PRINT OUT]: Printer output key

This key outputs measured results to the printer.

For print examples, refer to paragraph 3.5.

(b) Selecting item menu

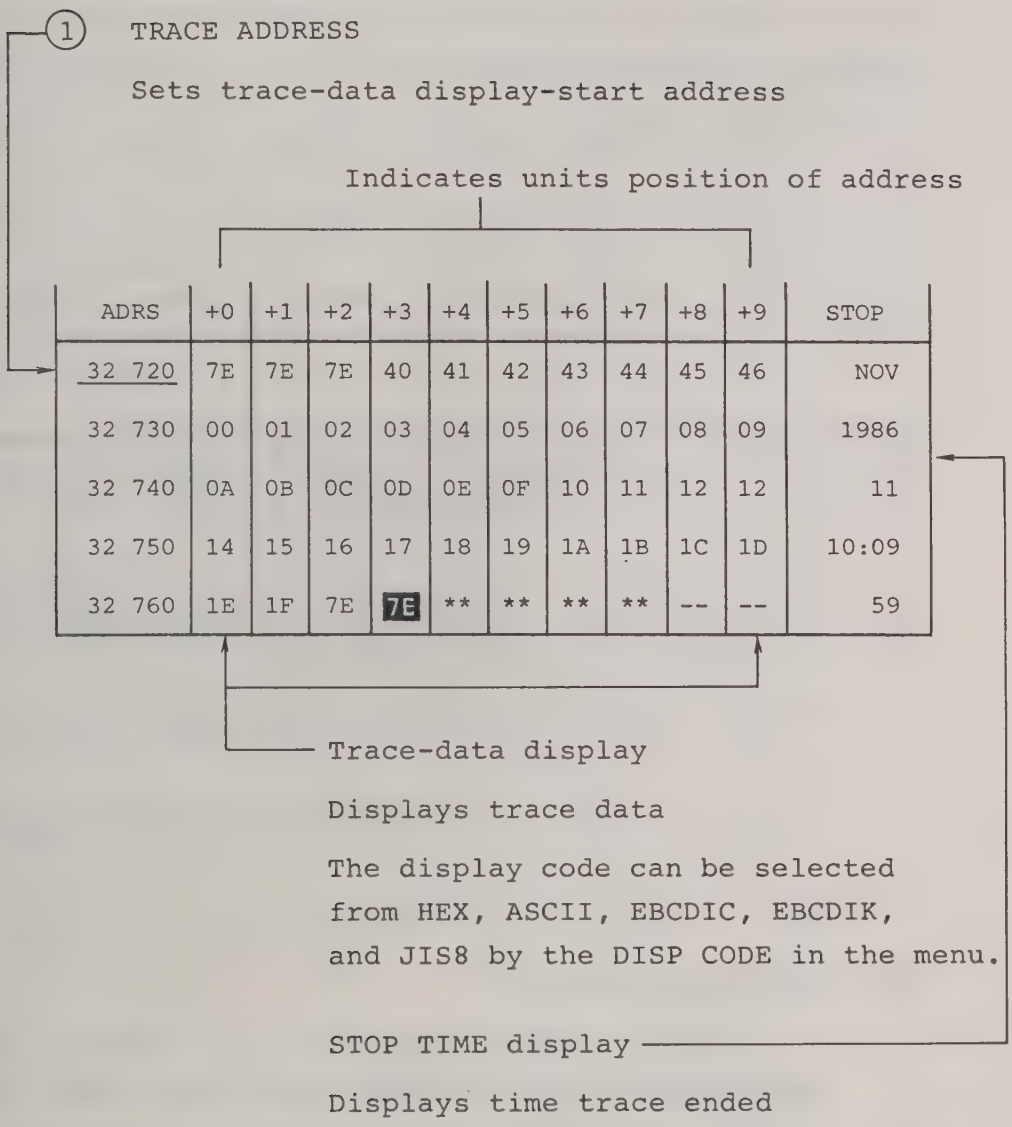
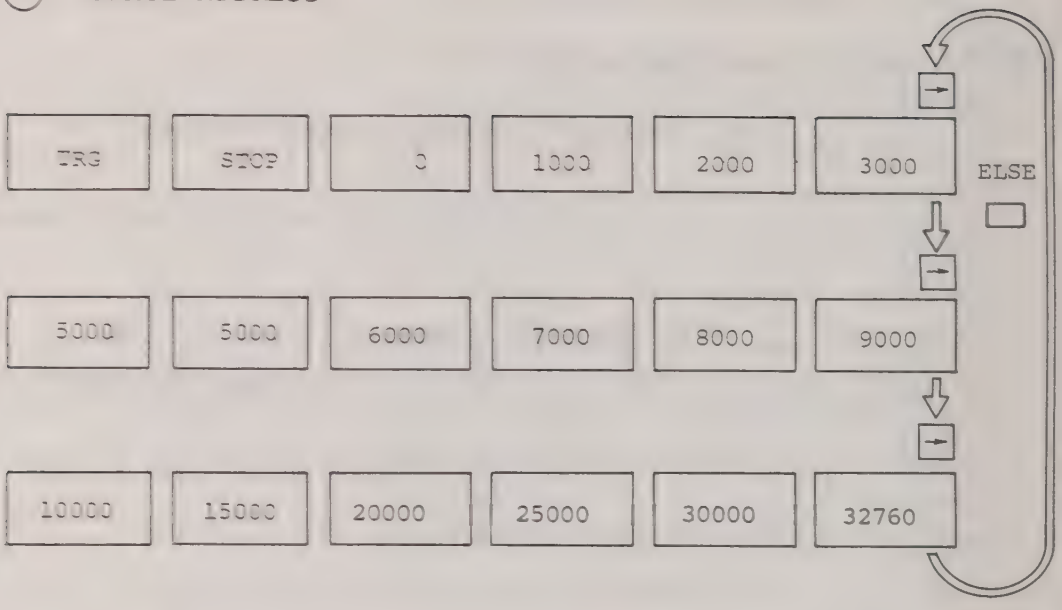

1
TRACE ADDRESS
Sets trace-data display-start address
Indicates units position of address
ADRS +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 STOP
32 720 7E 7E 7E 40 41 42 43 44 45 46 NOV
32 730 00 01 02 03 04 05 06 07 08 09 1986
32 740 0A 0B 0C 0D 0E 0F 10 11 12 12 11
32 750 14 15 16 17 18 19 1A 1B 1C 1D 10:09
32 760 1E 1F 7E 7E ** ** ** ** -- -- 59
Trace-data display
Displays trace data
The display code can be selected from HEX, ASCII, EBCDIC, EBCDIK, and JIS8 by the DISP CODE in the menu.
STOP TIME display
Displays time trace ended

Fig. 3-29 PATTERN TRACE-Screen Items

① TRACE ADDRESS



The above trace address can be changed from 0 to 32760 (10 steps) by pressing [MODIFY]

[TRG]: Line containing trigger made last position of page

[STOP]: Last line made last position of page

(6) Extended function

When a function extension unit (MD0607A, MD0610B, MD0611A/B/C/D) is inserted into a main frame, the screen that corresponds to the functions of that unit appears.

For details, refer to the operation manual of each unit.

3.4.5 CLOCK SOURCE screen

When [CLOCK SOURCE] is selected on the MODE screen menu (paragraph 3.4.2), the CLOCK SOURCE screen appears.

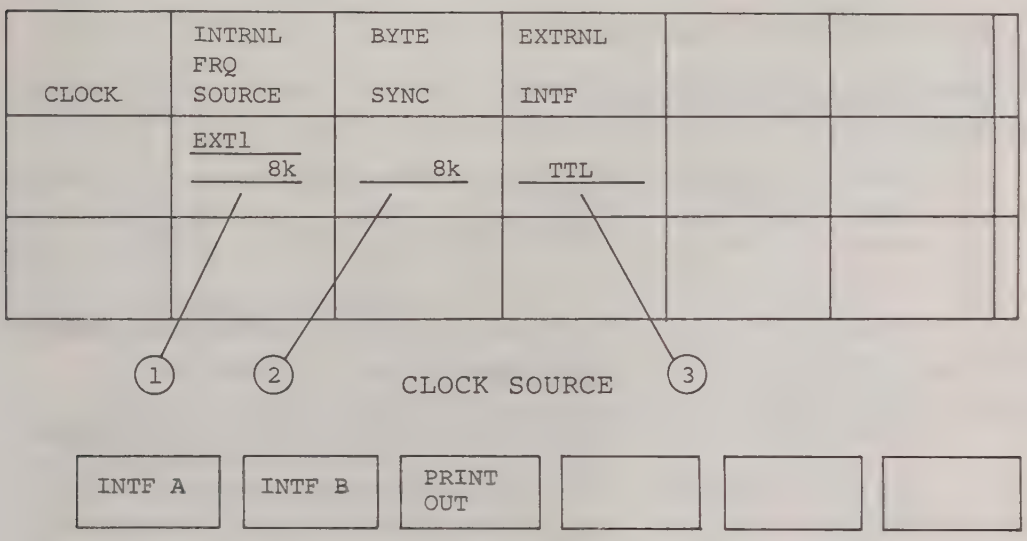


Fig. 3-30 CLOCK SOURCE Screen

(1) Selecting function menu

Fig. 3-31 CLOCK SOURCE-Screen Function Menu

[INTF A]/[INTF B]: INTERFACE screen changeover key

The screen is switched to the INTF A screen or INTF B screen by pressing this key.

The INTERFACE screen is used to select the send/receive units used in measurement, and to set the interface send/receive conditions.

[PRINT OUT]: Printer output key

This key outputs the CLOCK SOURCE set contents at the built-in printer.

(2) Selecting item menu

① INTERNAL FRQ SOURCE

[SELF]: Self-oscillation inside instrument (±10 ppm)

[EXT1 8k]: Slave to external input 8 k clock

[EXT2 64k+8k]: Slave to external input 64 k + 8 k clock

[RD]: Slave to receive-date clock component

There is no RD-slave method for V.24, V.35, V.36, X.20/X.21, and TTL interfaces. (If RD is set, self-oscillation is performed.)

Note:

For V.25, V.35, V.36, X.20/X.21, and TTL interfaces, there is no method which is slave to EXT1 8k or EXT2 64k+8k, however, it is effective for increasing the frequency accuracy of the internal source clock.

② BYTE SYNC

Set when INTERNAL FRQ SOURCE ① setting is not SELF.

[8K]: For 64 kb/s (MD0602A, MD0602E), the send/ receive byte phase is matched to the external input (64 k + 8 k) or 8 k.

[OFF]: Byte clock free

③ EXTERNAL INTERFACE

Sets level type of external input interface when [EXT1 8k] or [EXT2 64k+8k] specified at INTERNAL FRQ SOURCE ① setting.

3.5 Explanation of Printer

The settings and measured results of each screen can be printed at the built-in printer.

3.5.1 Printing at MODE screen

Press [PRINT TEST] at the MODE screen menu (paragraph 3.4.2) to execute the printing test.

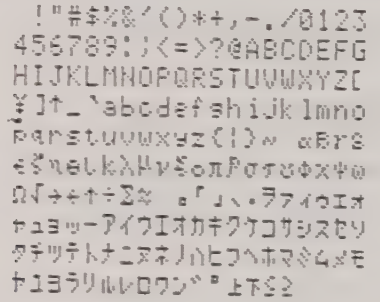


Fig. 3-22 Printing Test Pattern

3.5.2 Print format at INTERFACE screen

Press [PRINT OUT] at the INTERFACE screen menu (paragraph 3.4.3) to print all the set items as follows:

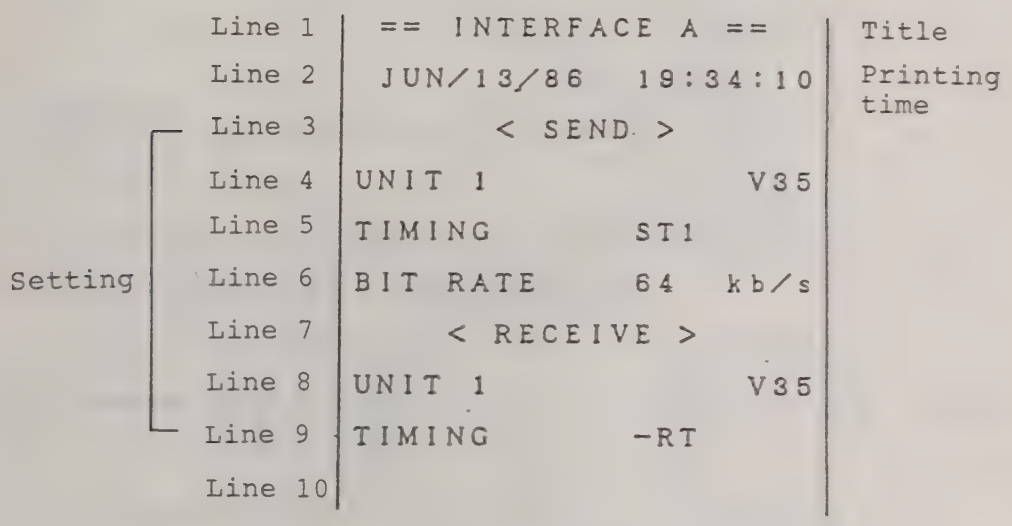


Fig. 3-33 Print Format at INTERFACE Screen

The print items are different for each interface screen.

3.5.3 Print format at ERROR screen

(1) Printing at measurement start

The folowing output is printed at measurement start.

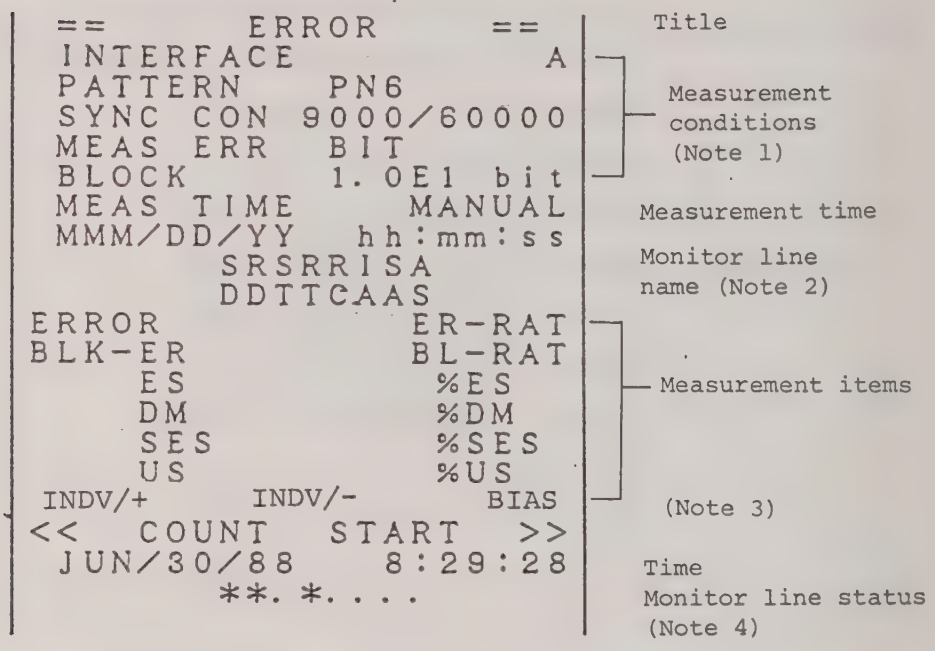


Fig. 3-34 Print Format at ERROR-Screen Measurment Start

Note 1:

SYNC CON .... Set value of PN sync. loss detection condition

None when PATTERN is PROGRAM

Note 2:

Send and receive lines are printed when different send and receive units are used.

Print character	Meaning
RC	REC
AS	AIS

Note 3:

Prints only when DIST unit (MD0610A) inserted and distortion measurement enabled.

Note 4:

This line is printed for each unit when the send and receive units are different.

* means ON or 1 (lamp on)

. means OFF or 0 (lamp off)

However, the status value becomes uncertain because of the printing timing when the signal line is repeatedly switched ON and OFF (e.g. RT and ST).

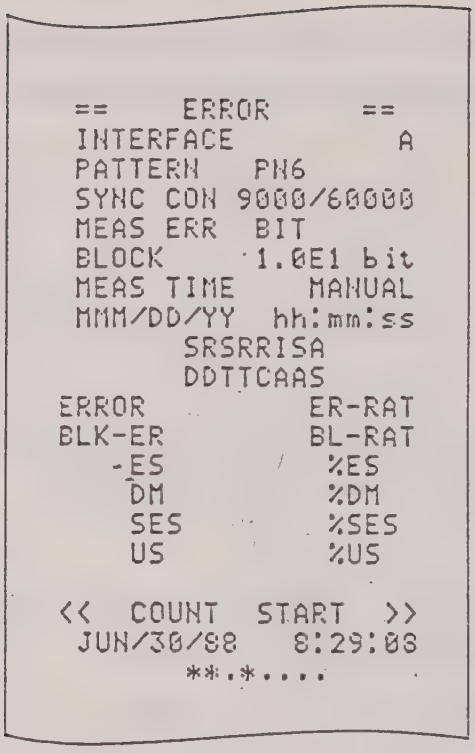


Fig. 3-35 ERROR-Screen Measurement-Start Printout Example

(2) Printing during measurment

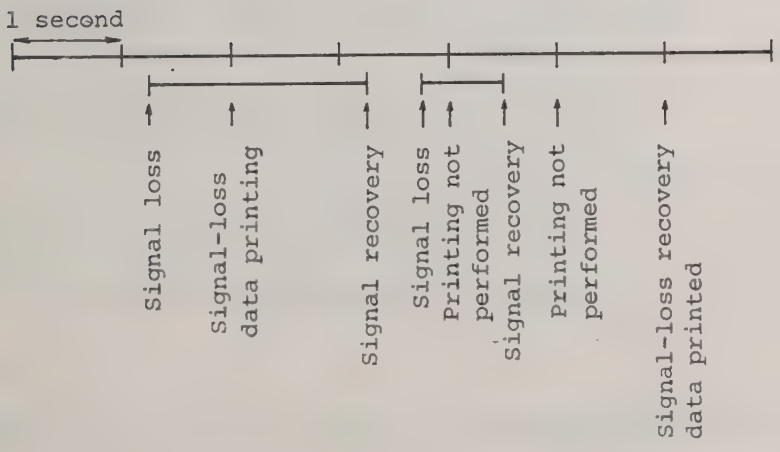
(a) Printing every second

If there is an error, or if a signal loss, AIS, frame sync. loss, or pattern sync. loss occurs as alarm during one second, Fig. 3-36 is printed. The priority of the alarm information is:

signal loss > AIS > frame sync. loss > pattern sunc. loss > X.50 frame sync. loss.

If several alarms are generated during one second, the alarm with the highest priority is printed.

If ignal loss occurs, printing stops after the loss is printed until the signal is recovered. (Even if the signal is recovered temporarily during one second, printing is not performed because signal loss is considered to be in progress even if it occurs only once.) When the signal is recovered, the time is printed.



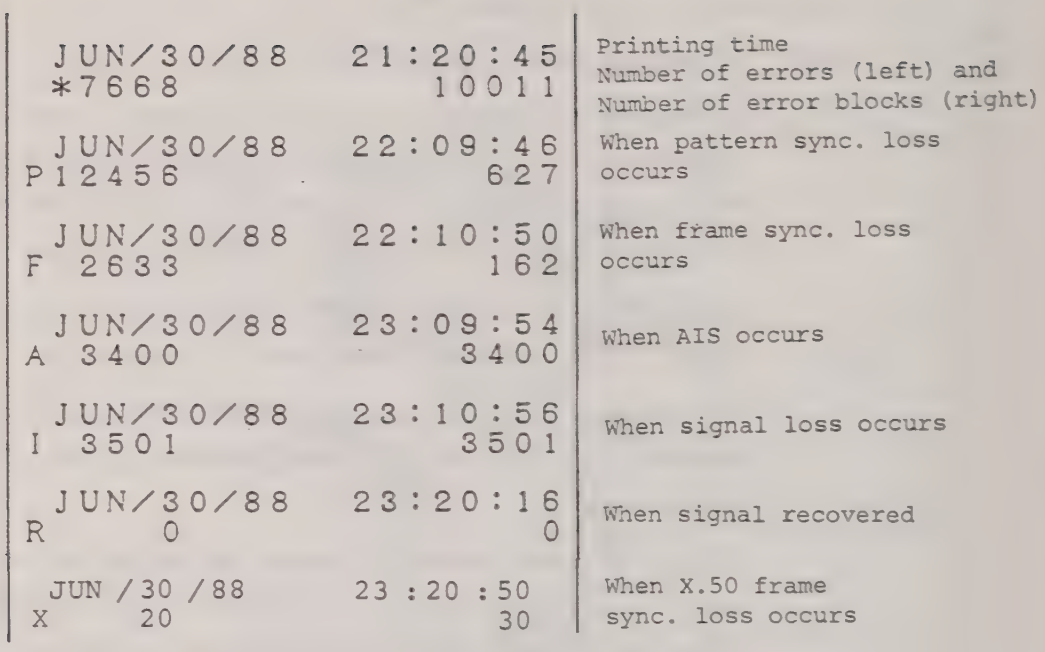


Fig. 3-36 Print Format of One-Second Data at Error Screen

The character R is printed at signal recovery when there is no pattern sync. loss, frame sync. loss, or AIS at the time of signal recovery; if any of these conditions occur, the condition is printed.

If a condition is printed, the time printed after I indicates the signal-recovery time.

The character R is also printed at print recovery when the paper-save function is used. (Refer to paragraph (6) below.)

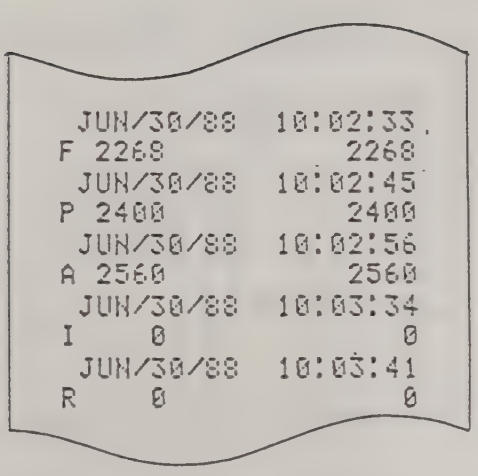


Fig. 3-37 ERROR-Screen One-Second Data Printout Example

(b) Printing during measurement

When [PRINT OUT] is pressed during measurment, the measured results from the measurement start to the time when the key was pressed are printed as follows:

```
<< ELAPSED   COUNT >>      - Title
  JUN/20/88  14:50:12      - Printing time
        ****.....          - Monitor-line status at printing
ERR    12345   1.6E -2   ┐
BLK     6401   8.1E -4   │
ES        90   1.7E-1%   │
DM         2   1.6E 0%   ├- Measured data
SES       10   1.3E 0%   │
US         6   6.1E 1%   │
DST      0 %    0 %  -1 % ┘
```

Note:

DST is only when distortion measurement enabled

Fig. 3-38 Print Format at ERROR Screen During Measurement

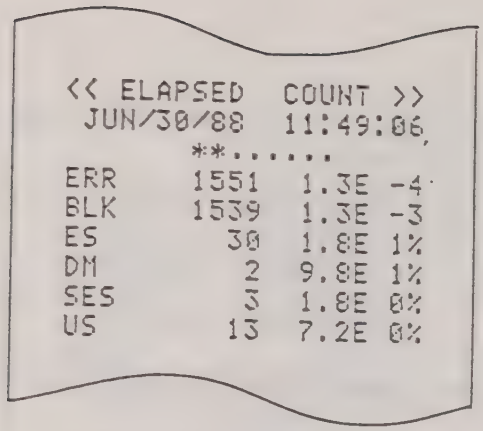


Fig. 3-39 ERROR-Screen Printout Example During Measurement

(3) Printing at measurement-period end

When repetitive measurement is selected, the following is output at the end of one measurement period:

```
<<   PERIOD COUNT   >>   — Title
 JUN/30/88   23:30:16    — Printing time
        ..**.....        — Monitor status at printing
ERR     54000   1.3E -5 ┐
BLK     54000   1.3E -4 │
ES       1000   7.6E 0% │
DM         20   6.9E 1% ├— Period end data
SES       102   1.0E 0% │
US         10   9.2E 0% │
DST        5%     6%  -2% ┘
```

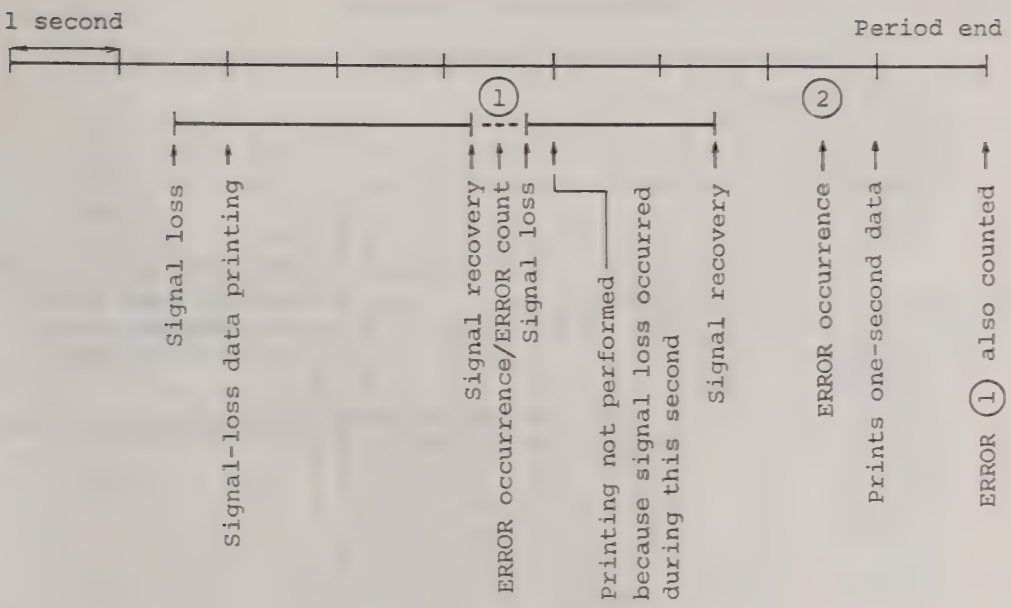
Note:

DST is only when distortion measurement enabled

Fig. 3-40 Print Format at ERROR-Screen Measurement-Period End

Note:

If signal loss occurs during measurement, the sum of the number of data errors in every second may be different from the number of errors at the period end.



When printing is suspended while signal loss occurs as shown above, sometimes the ERROR data for one second may not be printed when the input is recovered. However, since the ERROR data is counted, it is printed in the period-end data.

```
<<  PERIOD COUNT  >>
 JUN/30/88  13:17:16
        ****....
ERR      235  3.1E -5
BLK      235  3.1E -4
ES         0  7.4E 0%
DM         1  9.7E 1%
SES        2  1.9E 0%
US        12  1.0E 1%
```

Fig. 3-41 ERROR-Screen Measurement-Period-End Printout Example

(4) Printing when measurement stopped

When measurement is stopped, printing is performed as follows:

```
<<  TOTAL  COUNT  >>        — Title
 JUN/30/88    8:24:50       — Measurement-stop time
      ****....              — Monitor line status when
TOTAL TIME 999:59:59        ┐ measurement stopped
ERR    99999   6.7E-10      ┘ Measurement time
BLK    88888   7.4E -9       ┐
ES      7766   1.8E-2%       │
DM       554   4.7E-1%       │ — Measurement end data
SES      447   5.6E-3%       │
US      1234   1.0E-2%       │
DST       9%     10%   60%   ┘
```

Note:

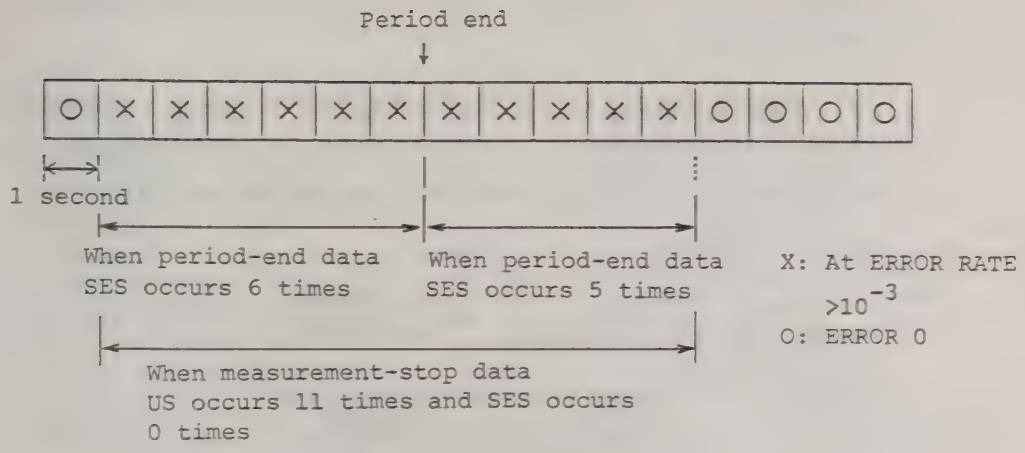
DST is only when distortion measurement enabled

Fig. 3-42 Print Format at ERROR Screen When Measurement Stopped

Note:

The final measured data for repetitive measurement is not the sum of each period-end data. It is the measured value from the measurement start to measurement stop.

Therefore, the sumof the data for each period may be different from the final measured data. (Refer to the figure on the next page.)


Period end
O X X X X X X X X X X X O O O O
1 second
When period-end data
SES occurs 6 times
When period-end data
SES occurs 5 times
X: At ERROR RATE
>10^-3
O: ERROR 0
When measurement-stop data
US occurs 11 times and SES occurs
0 times

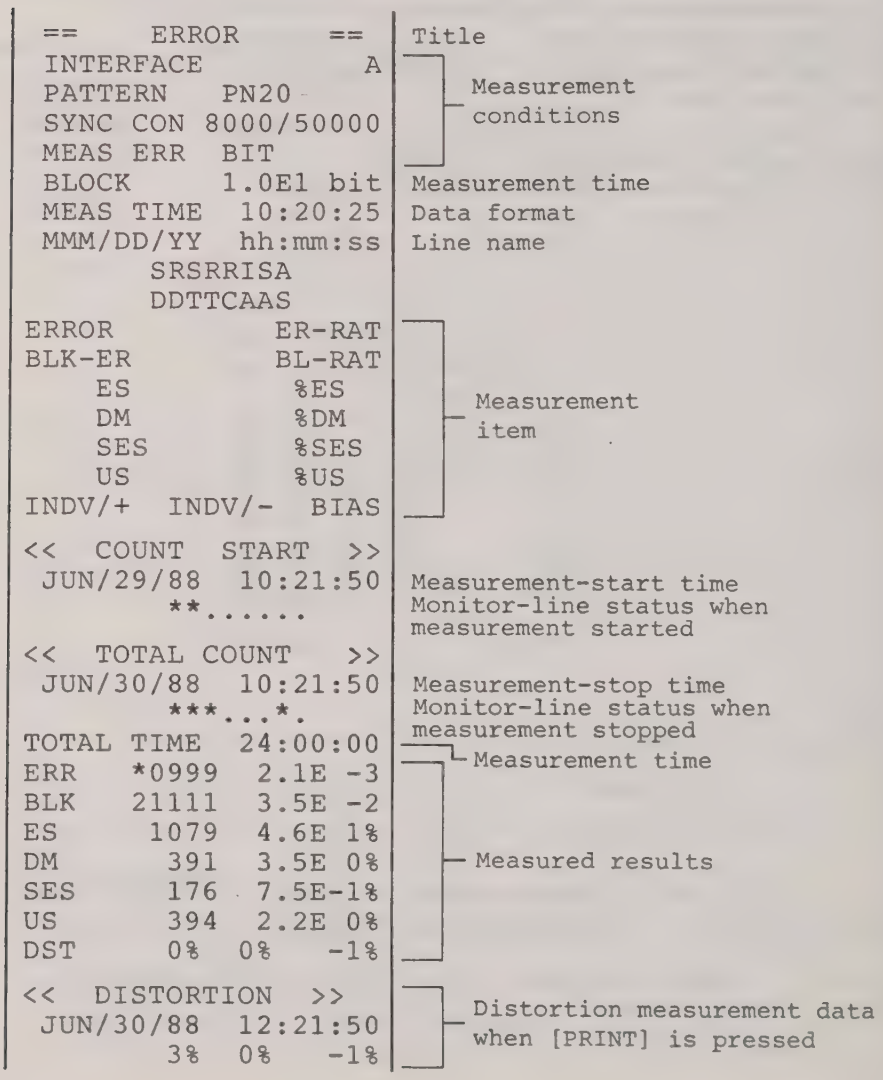
```
<<  TOTAL  COUNT  >>
 JUN/30/88  13:19:16
        **.*....
TOTAL TIME    0:04:00
ERR       527  3.4E -5
BLK       527  3.4E -4
ES         16  7.7E 0%
DM          2  9.2E 1%
SES         7  3.4E 0%
US         33  1.4E 1%
```

Fig. 3-43 Error-Screen Printout Example When Measurement Stopped

(5) Printing while measurement stopped

When [PRINT OUT] is pressed while measurement is stopped, the previous measured data is printed as shown below.

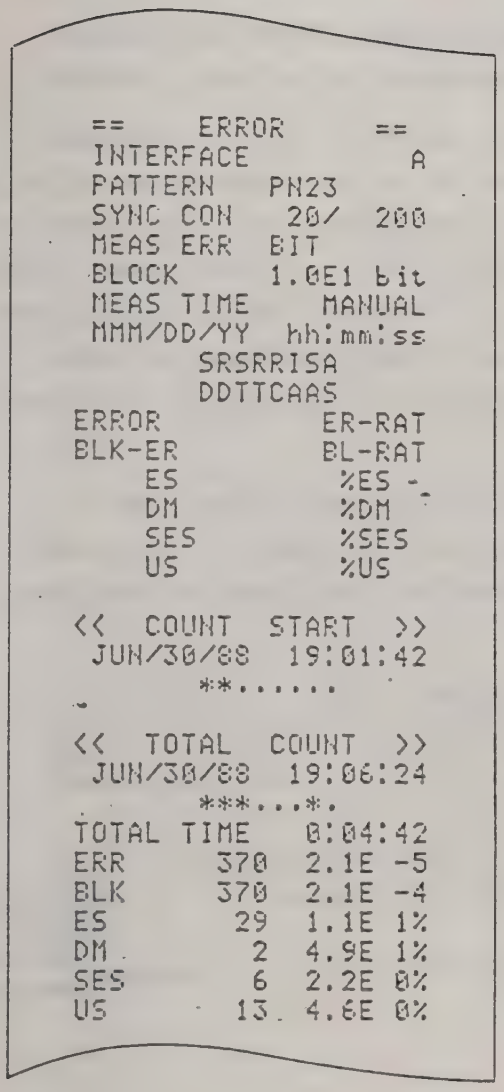
When there is no measured data (e.g. immediately after the power-on), 0 is printed as the measured time data and --- is printed as the measured results.



Note:

BIAS and DST are only when distortion measurement enabled

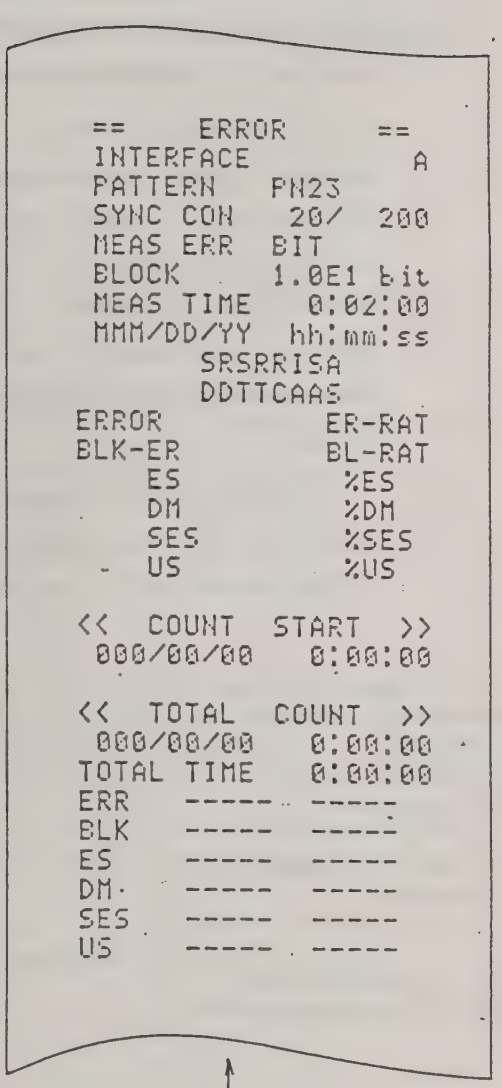
Fig. 3-44 Print Format at ERROR Screen While Measurement Stopped



```
==    ERROR      ==
INTERFACE          A
PATTERN    PN23
SYNC CON    20/  200
MEAS ERR   BIT
BLOCK      1.0E1 bit
MEAS TIME     MANUAL
MMM/DD/YY  hh:mm:ss
       SRSRRISA
       DDTTCAAS
ERROR          ER-RAT
BLK-ER         BL-RAT
    ES          %ES
    DM          %DM
    SES         %SES
    US          %US

<<  COUNT  START  >>
 JUN/30/88  19:01:42
       **.....

<<  TOTAL  COUNT  >>
 JUN/30/88  19:06:24
       ***...*.
TOTAL TIME    0:04:42
ERR     370   2.1E -5
BLK     370   2.1E -4
ES       29   1.1E 1%
DM        2   4.9E 1%
SES       6   2.2E 0%
US       13   4.6E 0%
```



```
==    ERROR      ==
INTERFACE          A
PATTERN    PN23
SYNC CON    20/  200
MEAS ERR   BIT
BLOCK      1.0E1 bit
MEAS TIME     0:02:00
MMM/DD/YY  hh:mm:ss
       SRSRRISA
       DDTTCAAS
ERROR          ER-RAT
BLK-ER         BL-RAT
    ES          %ES
    DM          %DM
    SES         %SES
    US          %US

<<  COUNT  START  >>
 000/00/00   0:00:00

<<  TOTAL  COUNT  >>
 000/00/00   0:00:00
TOTAL TIME    0:00:00
ERR     -----  -----
BLK     -----  -----
ES      -----  -----
DM      -----  -----
SES     -----  -----
US      -----  -----
```

In the example above, there is no measured data.

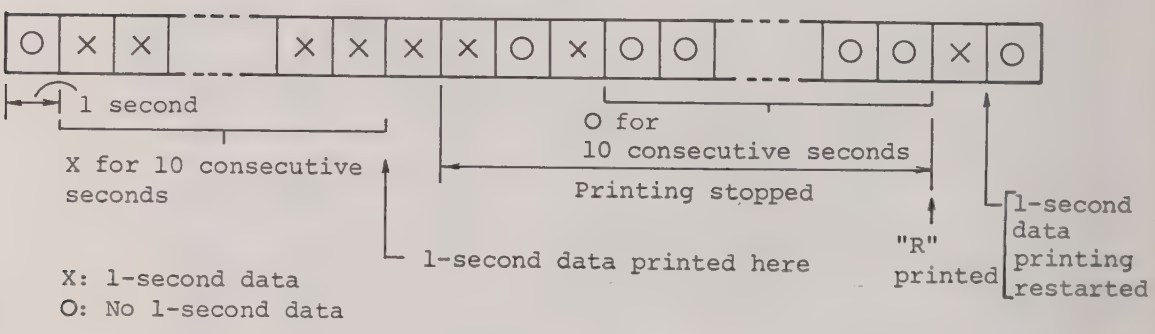
Fig. 3-45 Error-Screen Printout Example When Measurement Stops

(6) Paper-save function

The paper-save function is set by a internal switch. (Refer to paragraph 3.1.3.)

If errors occur continuously for ten seconds during ERROR measurement, this function stops printing of the one-second data after eleven seconds (counting of errors occuring during this time continues). When there are no errors for 10 seconds after the printer stops, one-second data printing is restarted when one-second data occurs after the 10-second no-error time.

When printing-stop is released, the time is printed and the printing-stop release is indicated. (The character R is printed at the head of the data.)


O X X X X X X O X O O O O X O
1 second
X for 10 consecutive seconds
O for 10 consecutive seconds
Printing stopped
1-second data printed here
"R" printed
1-second data printing restarted
X: 1-second data
O: No 1-second data

Even when printing is stopped, the signal-loss and recovery times are printed.

3.5.4 Print format at VOLT/FREQUENCY screen

When [PRINT OUT] is pressed at the VOLT/FREQUENCY screen, the following data is printed.

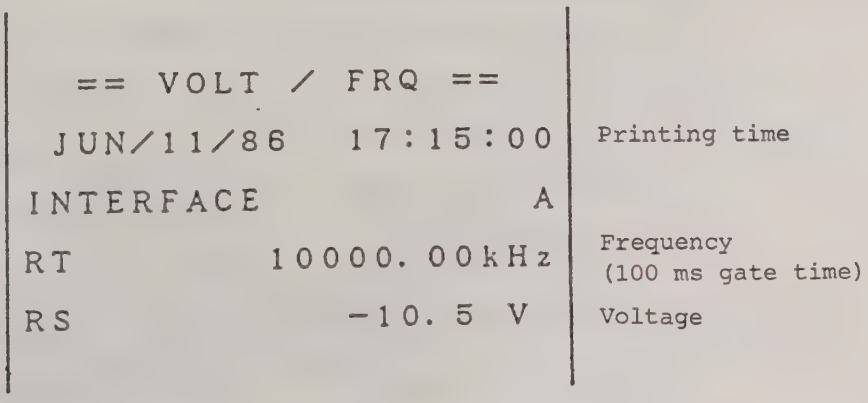


Fig. 3-46 Print Format at VOLT/FREQUENCY Screen

3.5.5 Print format at DELAY screen

(1) Printing at TRANSMIT DELAY

When [PRINT OUT] is pressed at TRANSMIT DELAY, the following is printed.

```
== DELAY ==
JUN/11/86  17:15:00
INTERFACE              A
TRANSMIT DELAY
          10000.00 ms
```

Fig. 3-47 Print Format at DELAY Screen (TRANSMIT DELAY)

(2) Printing at LINE INTERVAL

When [PRINT OUT] is pressed at LINE INTERVAL, the following is printed.

```
== DELAY ==
JUN/11/86  17:15:00
INTERFACE              B
START     RS   OFF→ON
STOP      CS    ON→OFF
INTRVL    10000.00 ms
```

Fig. 3-48 Print Format at DELAY Screen (LINE INTERVAL)

3.5.6 Print format at WORD TRACE screen

When [PRINT OUT] is pressed at the WORD TRACE screen, the following is printed.

```
  == WORD TRACE ==
 JUN/13/86   19:47:00
INTERFACE            A
SEND METHD      MANUAL
IDLE PATRN  0110 0101
WORD LNGTH  1024 byte   ← WORD PATTERN not printed
TRAC STOP       MANUAL
SYNC CODE   0111 1110
STOP DELY    512 byte
STOP CODE                ← Printed even at manual TRACE STOP
       NOT  10×0 11×0
```

Fig. 3-49 Print Format at WORD TRACE Screen

3.5.7 Print Format at TRACE DISPLAY screen

When [PRINT OUT] is pressed at the TRACE DISPLAY screen, the following is printed.

HEX MODE

```
Line 1  == PATTERN TRACE ==
Line 2    JUN/11/86   17:15:10
Line 3  DISP CODE          HEX
Line 4  32720  7E  7E  7E  40  41
Line 5  32725  42  43  44  45  46
Line 6  32730  00  01  02  03  04
Line 7  32735  05  06  07  08  09
Line 8  32740→0A  0B  0C  0D  0E   ← 0A is the trigger
Line 9  32745  0F  10  11  12  13
Line 10 32750  14  15  16  17  18
Line 11 32755  19  1A  1B  1C  1D
Line 12 32760  1E  1F  7E  7E  **
Line 13 32765  **  **  **  --  --
```

JIS8 MODE

```
Line 1  == PATTERN TRACE ==
Line 2    JUN/11/86   17:15:10
Line 3  DISP CODE       JIS 8.
Line 4  32720   ~   ~   ~   @   A
Line 5  32725   B   C   D   E   F
Line 6  32730  NL  SH  SX  EX  ET
Line 7  32735  EQ  AK  BL  BS  HT
Line 8  32740→LF  VT  FF  CR  SO   ← LF is the trigger
Line 9  32745  SI  DE  D1  D2  D3
Line 10 32750  D4  NK  SN  EB  CN
Line 11 32755  EM  SB  EC  FS  G5
Line 12 32760  RS  US   ~   ~  **
Line 13 32765  **  **  **  --  --
```

Fig. 3-50 Print Format at TRACE DISPLAY Screen

SECTION 4

PRINCIPLES OF OPERATION

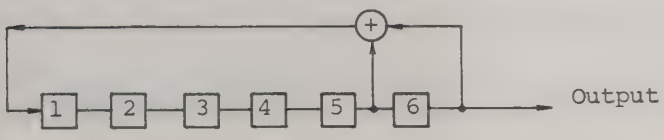
4.1 Error Measurement

(1) Pseudorandom pattern generator

The block diagram of the MD6401A pseudorandom pattern generator is shown below. The examples shown below are all for positive logic. The output is inverted for negative logic (INV).

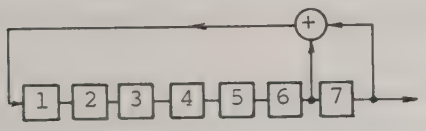
(a) PN6 (2^6-1, 63 patterns)

$1 + X^5 + X^6$



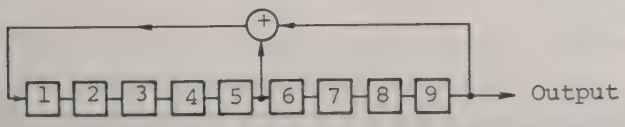
(b) PN7 (2^7-1, 127 patterns)

$1 + X^6 + X^7$ Complies with CCITT V.29



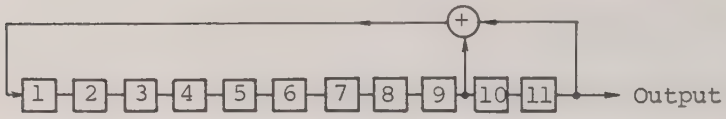
(c) PN9 (2^9-1, 511 patterns)

$1 + X^5 + X^9$ Complies with CCITT V.52



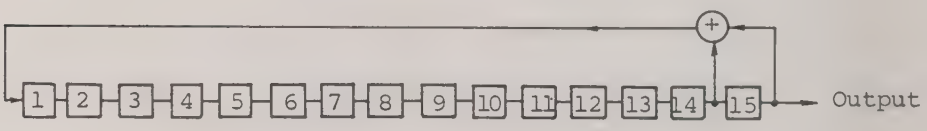
(d) PN11 (2^{11}-1, 2047 patterns)

$1 + X^9 + X^{11}$ Complies with CCITT 0.152



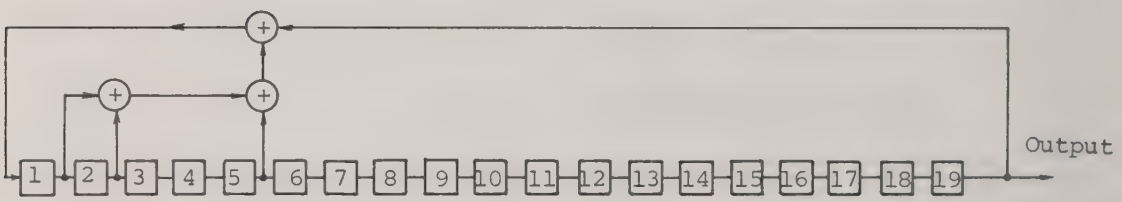
(e) PN15 (2^{15}-1)

$1 + X^{14} + X^{15}$ Complies with CCITT 0.151 (However, CCITT 0.151 specifies inverted output)



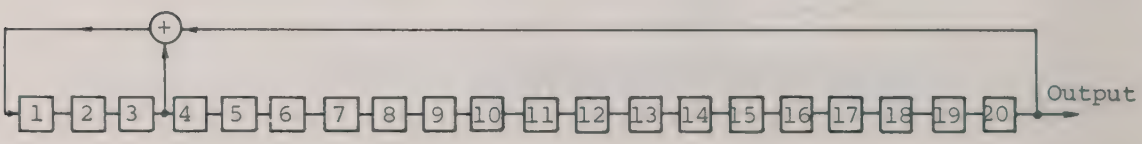
(f) PN19 (2^{19}-1)

$1 + X + X^2 + X^5 + X^{19}$



(g) PN20 (2^{20}-1)

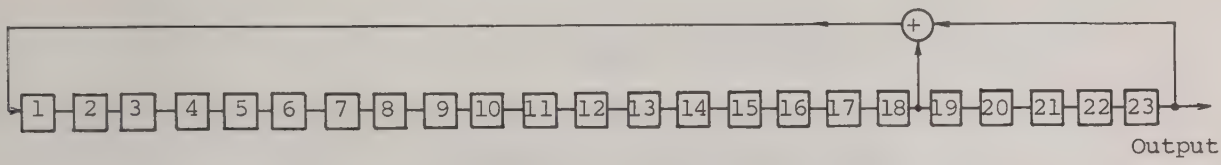
$1 + X^3 + X^{20}$ Complies with CCITT V.57



(h) PN23 $(2^{23}-1)$

$1 + X^{18} + X^{23}$ Complies with CCITT 0.151

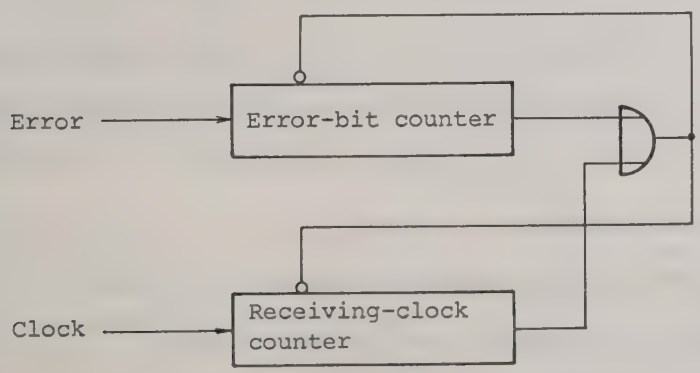
(However, CCITT 0.151 specifies inverted output)



(2) Pseudoramdom-pattern sync.-loss detection condition

If an error occurs at more than n bits in m bits of the receiving clock, pseudorandom-pattern sync. loss is recognized. Sync. loss is recognized at the time when n-bit errors are counted. The error-bit counter is cleared when the m-bit receiving clocks have counted.

During sync. loss, both error-bit and receiving-clock counters stop counting. After sync. is re-established, counting starts from 0.



Any value can be set for m and n.

There is also an AUTO setting mode. The m and n values set by BIT RATE and interface unit in AUTO mode are shown on the next page.

1. V.24, X.20, and TTL interfaces

   m = 50, n = 20 20/50 (Fixed)

2. V.35, V.36, X.21, 64K, and 64K G703 interface

   m = 512, n = 200

   200/512 (Fixed)

3. (1/5M, 2.0M, 6.3M, 8.4M) BIPOLAR and (80K, 1.5M, 2.0M, 6.3M) CMI interfaces

   m = 512 x N, n = 200 x N

   (200 x N)/(512 x N)

   N is as shown below by BIT RATE

N = 1 (BIT RATE: 2.4 to 80 kb/s)

N = 2 (BIT RATE: 128 to 192 kb/s)

N = 4 (BIT RATE: 256 to 384 kb/s)

N = 8 (BIT RATE: 448 to 768 kb/s)

N = 16 (BIT RATE: 832 to 1544 kb/s)

N = 32 (BIT RATE: 1600 to 3072 kb/s)

N = 64 (BIT RATE: 3136 to 8448 kb/s)

(3) Pseudorandom-pattern sync. establishment conditions

When an error is not detected in 24 cvonsecutive bits after sync. loss, sync. recovery is recognized.

(4) Fixed pattern

Any 8-bit programmable pattern can set.

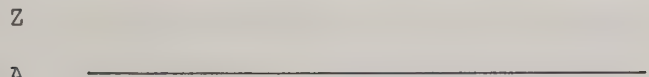
The m:n code pattern is shown below.

(a) Z: "All 1"

Z ————————————————————————————

A

(b) A: "All 0"



(c) 1:1 10

(d) 1:3 1000

(e) 3:1 1110

(f) 1:4 10000

(g) 4:1 11110

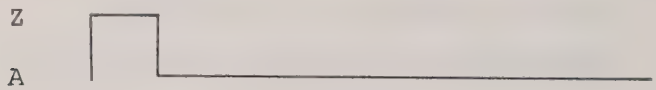
Note:

Error measurement cannot be performed for the 1:4 and 4:1 patterns by start-stop (8 bits) of 64K and 64K G.703 units and interface-with-frame time-slot specification..

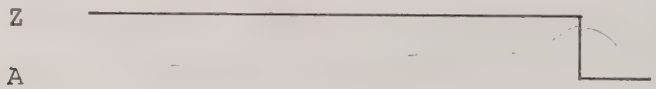
Examples:

1. MD0601A/D and MD0606A at both Timing ST/SP and 8-bit data length.
2. MD0602A and MD0606E
3. MD0602B, MD0603A/A1/B, and MD0604A/B/C/D/E with frame except NOF (No frame)

(h) 1:7 10000000



(i) 7:1 11111110



(5) Error performance

With the MD6401A, error measurement is defined according to the CCITT G.821 64 kb/s specification. (A BIT RATE of less than 64 kb/s is treated similarly.)

(a) ERROR RATE

$$\text{ERROR RATE} = \frac{\text{Number of error bits}}{\text{Number of data bits}}$$

(b) BLOCK ERROR

Number of blocks in which error occurred

(c) BLOCK ERROR RATE

$$\text{BLOCK ERROR RATE} = \frac{\text{Number of error blocks}}{\text{Number of measurement blocks}}$$

(d) ES (ERRORED SECONDS)

Number of seconds in which one or more errors, signal loss, or sync. loss occurred.

(However, excludes number of US)

(e) %ES

$$\%ES = \frac{ES}{\text{Effective measurement time}} \times 100\%$$

(Note on next page)

(f) SES (SEVERELY ERRORED SECONDS)

Number of seconds in which rrror rate exceeded 10^{-3} or 10^{-4} or signal loss or sync. loss occurred at least once (However, excludes number of US). The error-rate threshold 10^{-3} and 10^{-4} is switched by main-frame internal switch. (Refer to paragraph 3.1.3.)

(g) $$\%SES = \frac{SES}{\text{Effective measurement time (Note)}} \times 100\%$$

(h) DM (DEGRADED MINUTES)

Number of minutes (residual effective measurement time [in minutes] from which SES seconds are subtracted) in which error rate exceeds 10^{-6}

(i) %DM

$$\%DM = \frac{DM}{\text{Effective measurement time}} \times 100\%$$

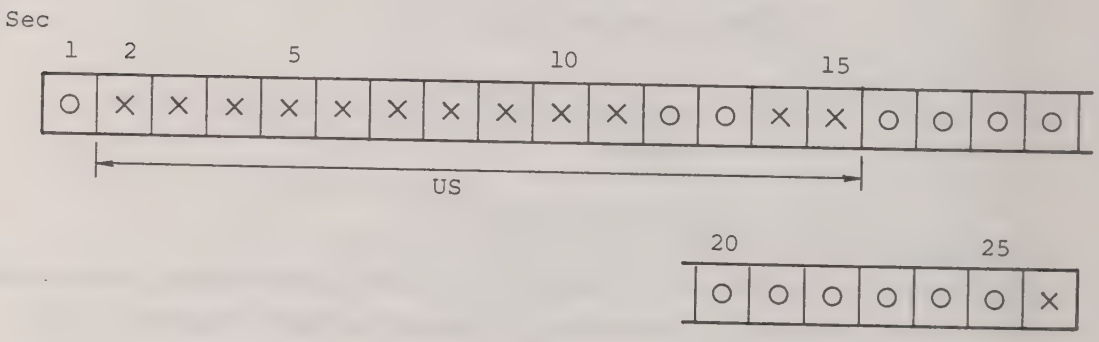
Note:

Effective measurement time = Measurement time - US

(j) US (UNAVAILABLE SECONDS)

Number of seconds from when SES state continues for 10 seconds until non-SES state continues for 10 seconds

Example:



X: SES

O: Not SES

US seconds are not counted in SES.

(k) %US

$$\%US = \frac{US}{\text{Measurement time}}$$

SECTION 5

SIMPLIFIED OPERATION TEST

5.1 Introduction

This section describes how to maintain the performance of the MD6401A.

5.2 Performance Test

Always insert an interface unit into the main frame when testing the MD6401A performance. The performance cannot be tested with the main frame only (or measurement unit, or remote control unit only).

5.2.1 Lamps and LCD test

After turning on the power, press [LAMP TEST] at the MODE screen. All the lamps come on for one second and then all segments of the LCD light.

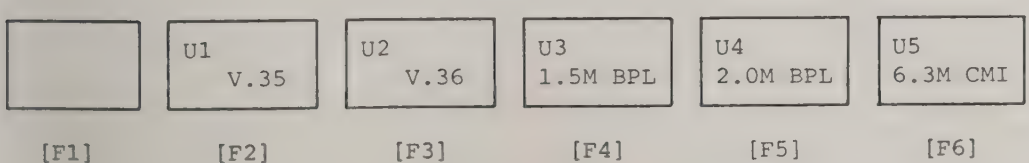
5.2.2 Printer test

Press [PRINT TEST] at the MODE screen.

The printer will then print all the printable characters.

5.2.3 Interface-unit insertion test

Move the cursor to the SEND (or RECEIVE) INTERFACE at the INTERFACE screen. Check that the inserted unit names are displayed in the menu.



5.2.4 Error-measurement test

Check the error measurement as described below in the SELF LOOP mode at the INTERFACE screen.

Move the cursor to the RECEIVE INTERFACE at the INTERFACE screen and press [SELF LOOP].

For V.24, V.35, V.36, X.20/X.21, and TTL units, set the SEND TIMING to ST1 and the RECEIVE TIMING to RT. (For units other than above, this setting is unnecessary after setting to SELF LOOP.)

Set the ERROR measurement screen.

Press [F1] (COUNT START) to start measurement.

When the characters CNT appear and the error count is 0, error measurement is normal.

Next, press [F1] (CH ER INSERT) and check that one error is counted.

5.2.5 DC-voltage measurement test

This test is effective only for units that can make DC voltage measurement (MD0601A/B/C/D). Set the SELF LOOP mode at INTERFACE screen as paragraph 5.2.4.

Select a measurement line that can be ON/OFF-controlled by the MD6401A. (Example: V.24 ER)

Set VOLT/FREQ screen.

Turn the control line ON and OFF to check that each voltage is within the specifications.

5.2.6 Frequency-measurement test

Set the SELF LOOP mode at the INTERFACE screen as paragraph 5.2.4.

Set the FREQ screen and start measurement.

Set the measurement line to ST.

For V.24, V.35, V.36, X.20/X.21, and TTL units, check that the measured value is the ST1 value set at the INTERFACE screen.

For other units, the measured value is the frequency of that unit.

(Example: 1.544 Mb/s for MD0602B 1.544M BPL unit)

APPENDIX A

ABBREVIATIONS

ES	Errored Second
DM	Degraded Minutes
SES	Severely Errored Seconds
US	Unavailable Seconds
CRC	Cyclic Redundancy Check
CMI	Coded Mark Inversion
AMI	Alternate Mark Inversion
PBX	Private Branch Exchanger
BPL	Bipolar
INF	Interface
AIS	Alarm Indication Signal
JIS	Japan Industrial Standard
RZ	Return to Zero
Si bit	Signaling bit
MFP	Multi-Frame Pattern
NTT	Nippon Telegraph and Telephone Corporation
DSU	Digital Service Unit
CCITT	Comité Consultatif International Télégraphique et Téléphonique
REC	Receive

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